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GUANGDONG AP TENON SCI.&TECH.CO.,LTD

TEST REPORT

SCOPE OF WORK
EMC TESTING–K7

REPORT NUMBER
200729051GZU-001

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TEST REPORT

Applicant Name & Address	:	GUANGDONG AP TENON SCI.&TECH.CO.,LTD 801-806,NO.3,ZEXI STREET,HANXI BUSINESS CENTER,PANYU DISTRICT,GUANGZHOU
Manufacturing Site	:	GUANGZHOU AP TENON PRECISION ELECTRONICS CO.,LTD NO.488,XINGYE ROAD,NANCUN TOWN,PANYU DISTRICT,GUANGZHOU
Intertek Report No:		200729051GZU-001
FCC ID:		2AW72SMARTLOCK20207

Test standards

47 CFR PART 15 Subpart C: 2019 section 15.249

Sample Description

Product	:	SMART LOCK
Model No.	:	K7
Electrical Rating	:	DC 6V from battery
Serial No.		Not Labeled
Date Received	:	29 July 2020
Date Test Conducted	:	20 August 2020-22 August 2020

Prepared and Checked By

Oscar Gao

Project Engineer

Approved By:

Helen Ma

Team Leader

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CONTENT

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1.0 TEST RESULT SUMMARY

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC PART 15 C Section 15.203	FCC PART 15 C Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.215(c)	ANSI C63.10: Clause 6.9	PASS
Radiated Emission	FCC PART 15 C section 15.249 (a), (d)	ANSI C63.10: Clause 6.4, 6.5 & 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.249 (d)	ANSI C63.10: Clause 6.10	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10: Clause 6.2	N/A

Remark:
N/A: not applicable. Refer to the relative section for the details.
EUT: In this whole report EUT means Equipment Under Test.
Tx: In this whole report Tx (or tx) means Transmitter.
Rx: In this whole report Rx (or rx) means Receiver.
RF: In this whole report RF means Radio Frequency.
ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

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2.0 General Description

2.1 Product Description

Operating Frequency:	2402 MHz – 2480MHz
Type of Modulation:	GFSK
Number of Channels:	40 Channels
Channel Separation:	2 MHz
Antenna Type:	Integral
Antenna Gain:	2.5 dBi
Speciality:	Bluetooth 4.0 with BLE (Bluetooth Low Energy)
Function:	Smart lock with BT function for remote control
Power Supply:	DC 6V
Power cord:	N/A

EUT channels and frequencies list:

Test frequencies are lowest channel 0: 2402 MHz, middle channel 19: 2440 MHz and highest channel 39: 2480 MHz.

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

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2.2 Related Submittal(s) Grants

This is an application for certification of:
DXX - Part 15 Low Power Communication Device Transmitter

Remaining portions are subject to the following procedures:
1. Receiver portion of BLE: exempt from technical requirement of this Part.
2. Fingerprint and Password function: FCC SDOC procedure.

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10. Radiated emission measurement was performed in semi-anechoic chamber. For radiated emission measurement, preliminary scans and final tests were performed in the semi-anechoic chamber to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise.

2.4 Test Facility

All tests were performed at:
Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China
Except Conducted Emissions was performed at:
Room 02, & 101/E201/E301/E401/E501/E601/E701/E801 of Room 01 1-8/F., No. 7-2. Caipin Road, Science City, GETDD, Guangzhou, Guangdong, China

A2LA Certificate Number 0078.10
Intertek Testing Services Shenzhen Ltd. Guangzhou Branch is accredited by A2LA and Listed in FCC website. FCC accredited test labs may perform both Certification testing under Parts 15 and 18 and Declaration of Conformity testing.

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, it was powered by 6V DC supply.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters

unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. The spurious emissions more than 20 dB below the permissible value are not reported.

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

3.2 EUT Exercising Software

Description	Manufacturer	Model No.	SN/Version	Supplied by
For fixing frequency	--	Nrfgostudio	Version: 1.0	client

3.3 Special Accessories

No special accessories used.

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3.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	20 dB Bandwidth	2.3%
	6dB Bandwidth	
	99% Bandwidth	
2	Carrier Frequencies Separated	2.3%
3	Dwell Time	1.2%
4	Maximum Peak Conducted Output Power	1.5dB
5	Peak Power Spectral Density	1.5dB
6	Out of Band Conducted Emissions	1.5dB
7	Band edges measurement	1.5dB
8	Radiated Emissions	4.7 dB (25 MHz-1 GHz)
		4.8 dB (1 GHz-18 GHz)
		5.21dB (18GZH-26GHz)
9	Conducted Emissions at Mains Terminals	2.58dB
10	Temperature	0.5 °C
11	Humidity	0.4 %
12	Time	1.2%

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty is calculated in accordance with ETSI TR 100 028-2001.
The measurement uncertainty is given with a confidence of 95%, k=2.

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

3.5 Equipment Modification

Any modifications installed previous to testing by GUANGDONG AP TENON SCI.&TECH.CO.,LTD will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

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3.6 Support Equipment List and Description

This product was tested with corresponding support equipment as below:

Support Equipment

Description	Manufacturer	Model No.	SN/Version	Supplied by
NoteBook	HP	Compaq 6710b	SN:CNU8240LF9	Intertek
Control board	client	CP2102	--	Client

4.0 Measurement Results

4.1 Antenna Requirement

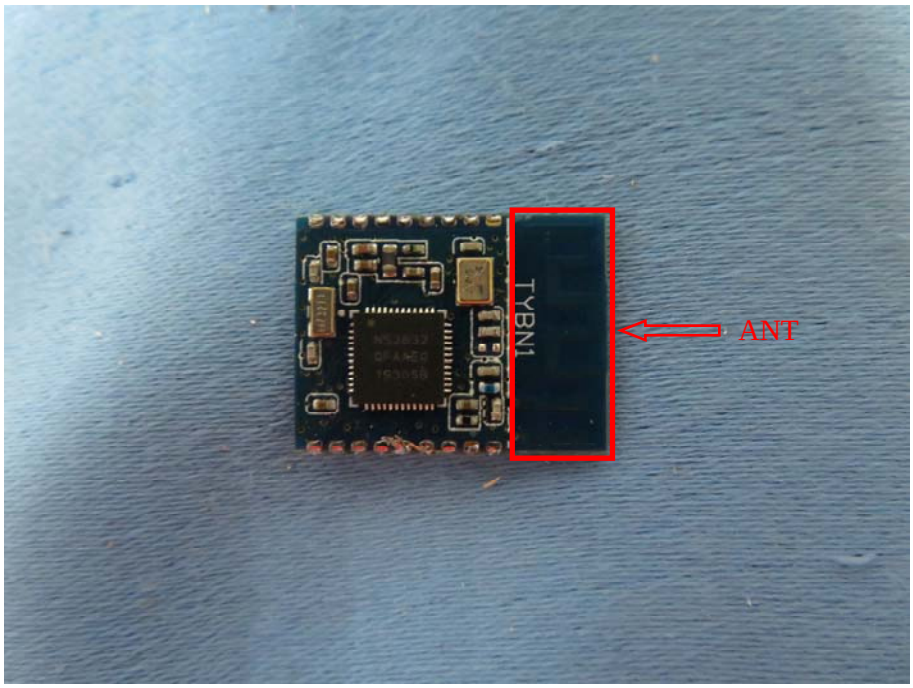
Standard requirement:

15.203 requirement:

For intentional device. According to 15.203 an intentional radiator shall be designed to Ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT Antenna

The antenna is an integral antenna and no consideration of replacement. The best case gain of the antenna is 2.5 dBi.



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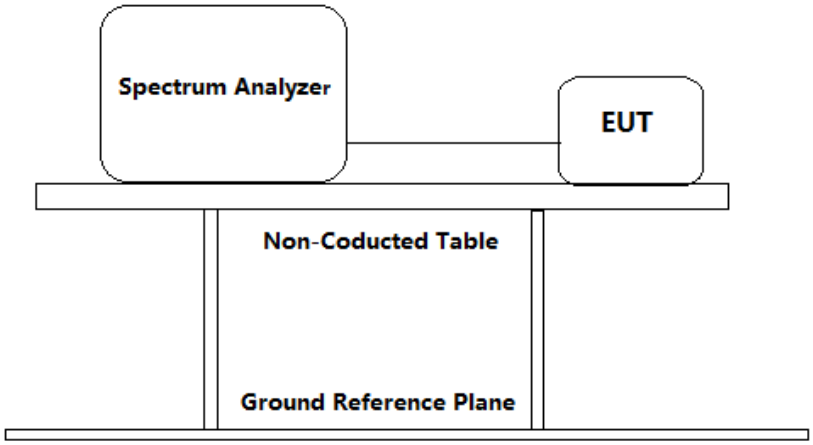
4.2 Occupied Bandwidth

Test Requirement:	FCC PART 15 C section 15.215(c) (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated
Test Method:	ANSI C63.10: Clause 6.9
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The highest, middle and the lowest channels were selected for the final test as listed below.

Test Configuration:



Test Procedure:

The transmitter was operated at its maximum carrier power measured under normal test conditions.

a) The instrument center frequency was set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer was between 1.5 times and 5.0 times the OBW(20 dB Bandwidth).
b) The nominal IF filter bandwidth (3 dB RBW) was in the range of 1% to 5% of the OBW, and VBW was approximately three times the RBW.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope was more than [10 log (OBW/RBW)] below the reference level.
d) Step a) through step c) might require iteration to adjust within the specified range.

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e) The dynamic range of the instrument at the selected RBW was more than 10 dB below the target "−20 dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW was at least 30 dB below the reference value.
f) Peak detection and max hold mode (until the trace stabilizes) was used.
g) Used the 20dB bandwidth function of the instrument and reported the measured bandwidth.
h) The occupied bandwidth was reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division was clearly labeled. Tabular data was reported in addition to the plot(s).

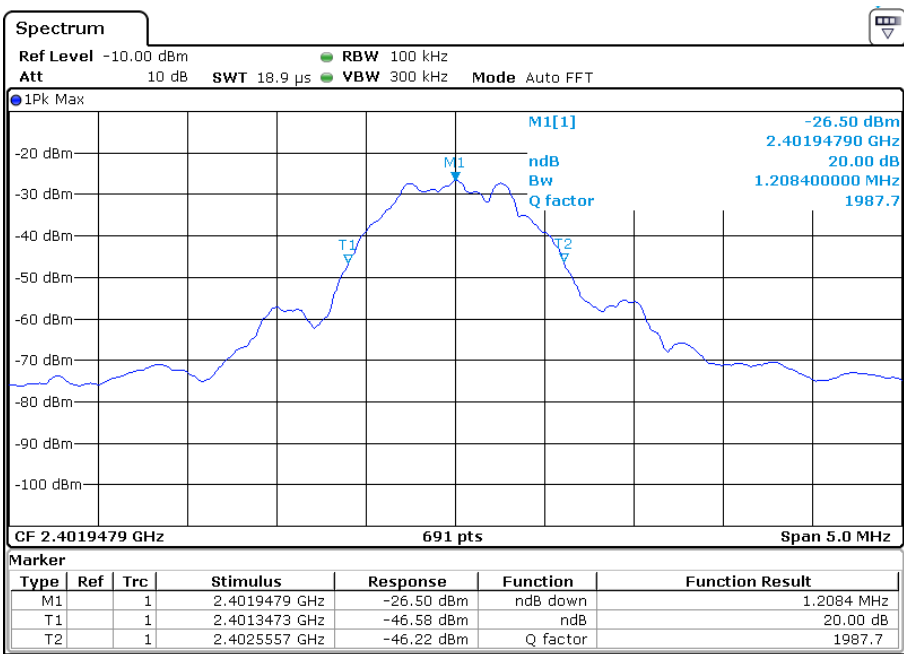
Used Test Equipment List
Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

20 dB bandwidth:

Channel No.	Frequency (MHz)	Measured 20dB bandwidth (MHz)	Limit (kHz)	Result
0	2402	1.208	/	Pass
19	2440	1.208		Pass
39	2480	1.216		Pass

Result plot as follows:

Lowest Channel(2.402 GHz):



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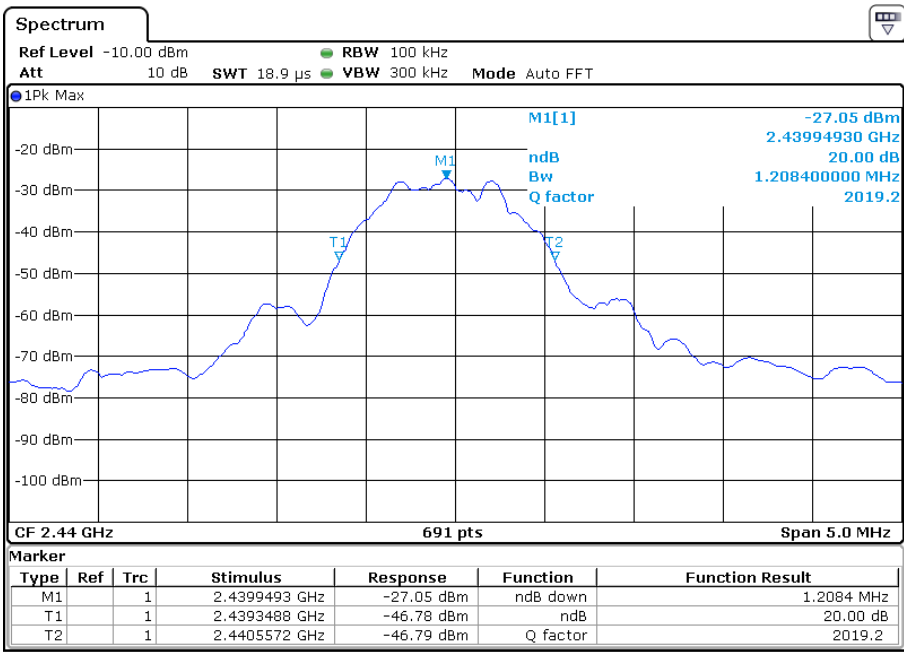
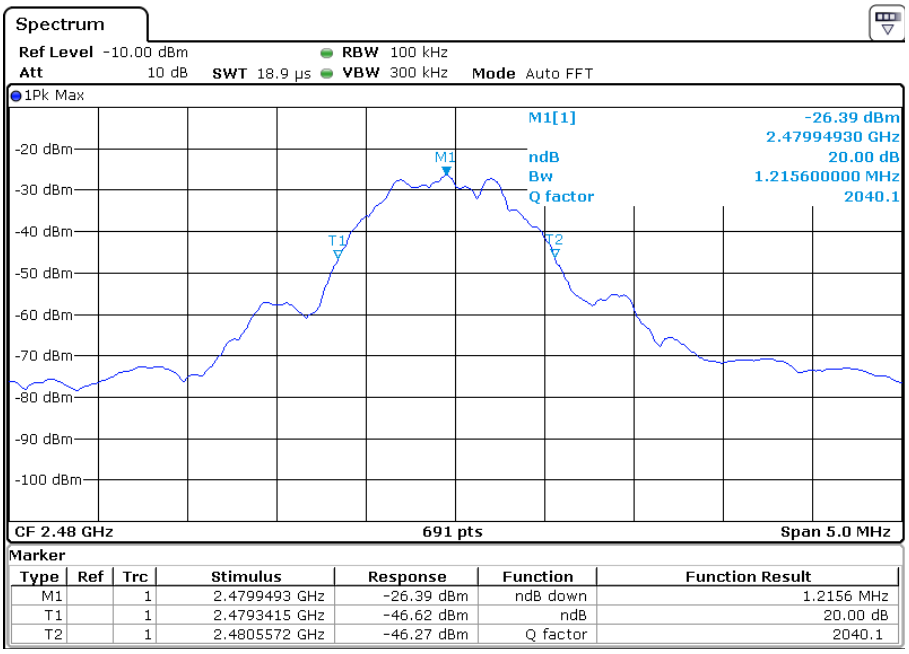
Middle Channel(2.440 GHz):



Highest Channel(2.480 GHz):



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4.3 Radiated Emission

Test Requirement: FCC PART 15 C section 15.249 (a), (d)

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBμV/m @ 3m)	Field Strength of Harmonics (dBμV/m @ 3m)
902 to 928	94.0	54.0
2400 to 2483.5	94.0	54.0
5725 to 5875	94.0	54.0

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in§ 15.209, whichever is the lesser attenuation.

Test Method: ANSI C63.10: Clause 6.4, 6.5 and 6.6

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The lowest, middle and the lowest channels were selected for the final test as listed below.

Test site: Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit: The field strength of radiated emission outside of the specified frequency bands, except for harmonics at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field Strength (dBμV/m @ 3m)
30-88	40.0
88-216	43.5
216-960	46.0
Above 960	54.0

Detector: For Peak and Quasi-Peak value:
200 Hz for 9 kHz to 150 kHz
9 kHz for 150 kHz to 30 MHz
120 kHz for 30 MHz to 1GHz
RBW = 1 MHz for f ≥ 1 GHz
VBW ≥ RBW

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Sweep = auto
Detector function = peak for f ≥ 1 GHz, QP for f < 1 GHz
Trace = max hold

Since the Occupied Bandwidth of fundamental frequency is above 1MHz, used RBW=2MHz for measuring Field Strength of fundamental.

Field Strength Calculation:

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below:
FS = RA + AF + CF - AG + PD + AV
FS = RA + Correct Factor + AV
FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV

Where:

AF = Antenna Factor in dB
CF = Cable Attenuation Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in –dB
Correct Factor = AF + CF – AG + PD

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:
FS = RA + AF + CF - AG + PD + AV
Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m.
RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
Correct Factor = 7.4 + 1.6 – 29.0 + 0 = -20 dB
FS = 62 + (-20) + (-10) = 32 dBµV/m

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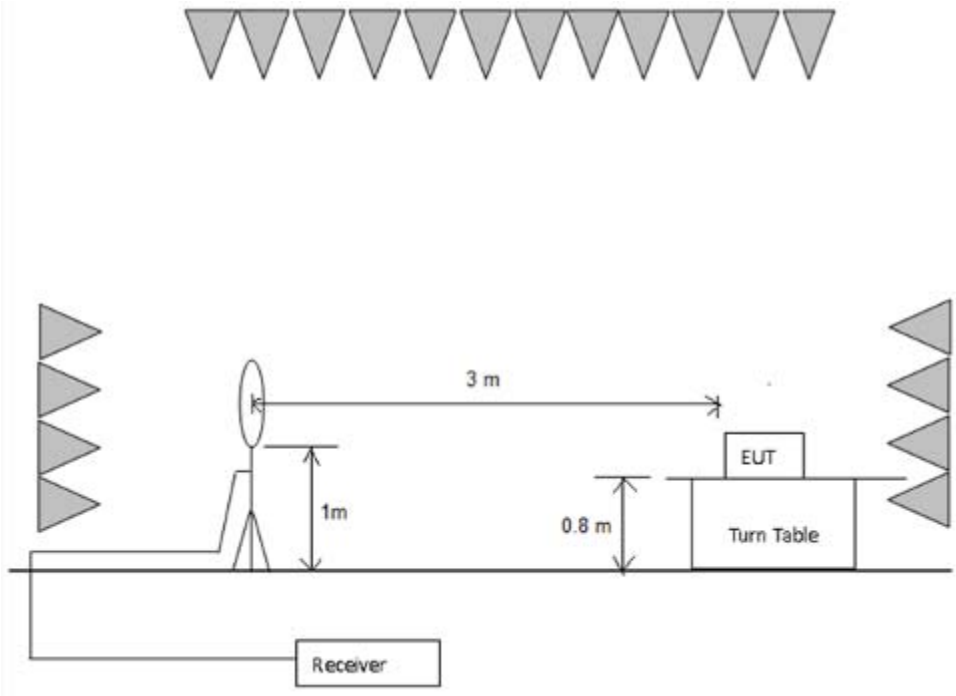
Section 15.205 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

Test Configuration:

1) 9 kHz to 30 MHz emissions:



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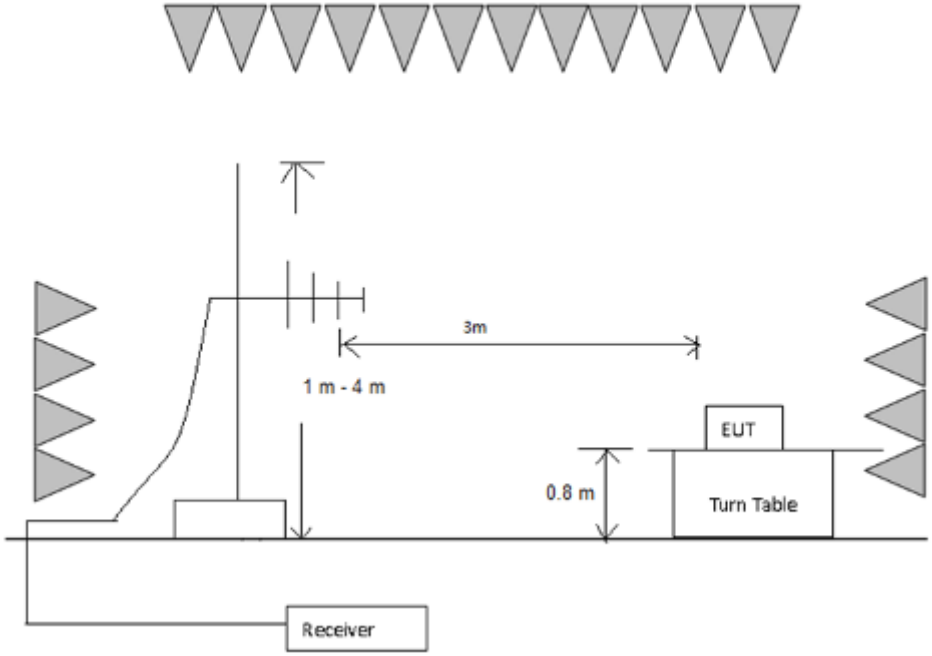
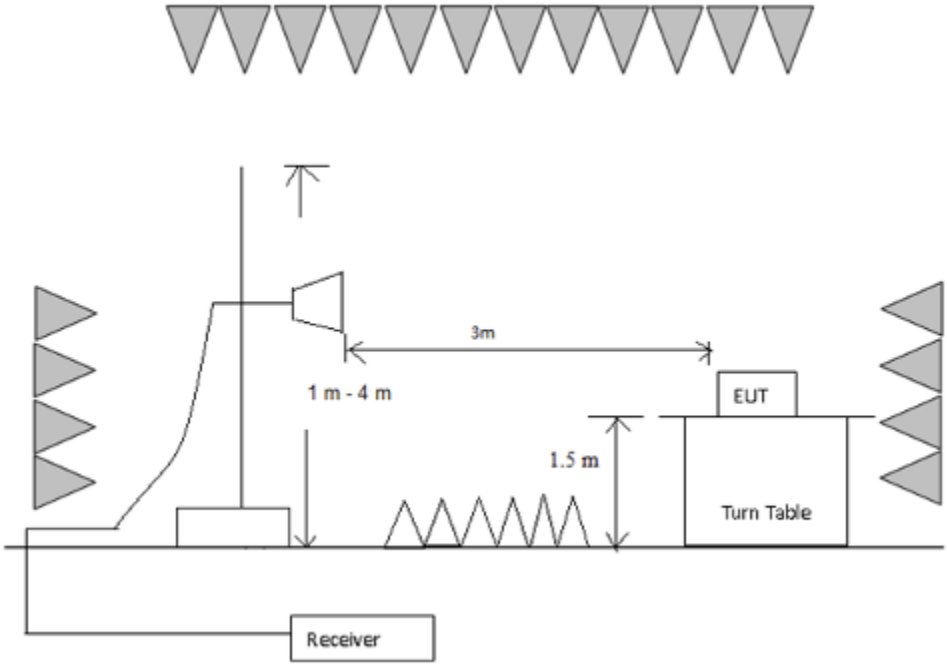
2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:



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Test Procedure:

1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The centre of the loop was positioned 1 m above the ground and positioned with its plane vertical at the special distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna. The measurement is performed with the EUT rotated 360º, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

3) 1 GHz to 25 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna. The measurement is performed with the EUT rotated 360º, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

4) The receiver was scanned from 9 kHz to 25 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

Used Test Equipment List:
3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz） (RX), Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

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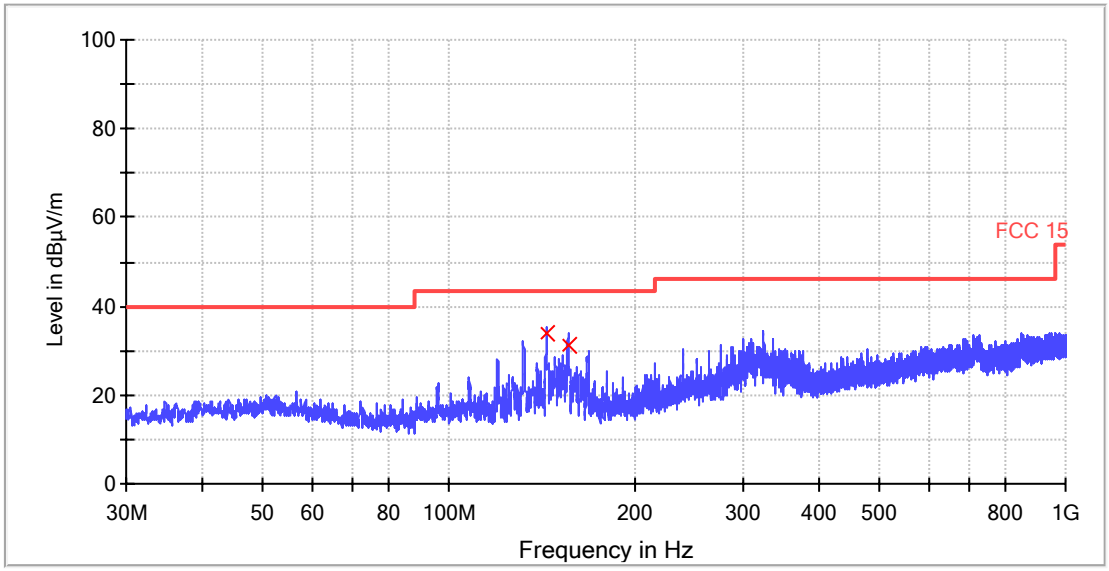
Radiated Emissions (Below 1GHz)

Operation Frequency: 2402MHz

Operation Mode: Continuously transmitting

Horizontal



QP

Frequency (MHz)	Quasi Peak (dBµV/m)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
144.080000	34.0	120.000	H	9.8	9.5	43.5
156.080000	31.4	120.000	H	10.2	12.1	43.5

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

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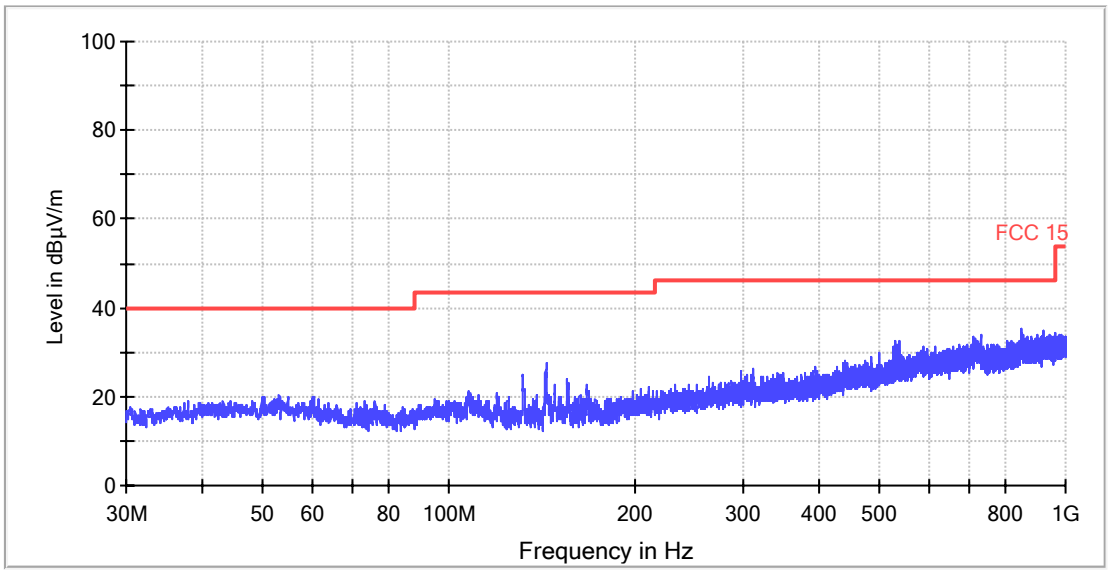
Operation Frequency: 2402MHz

Operation Mode: Continuously transmitting

Vertical



All emission levels are more than 6 dB below the limit.

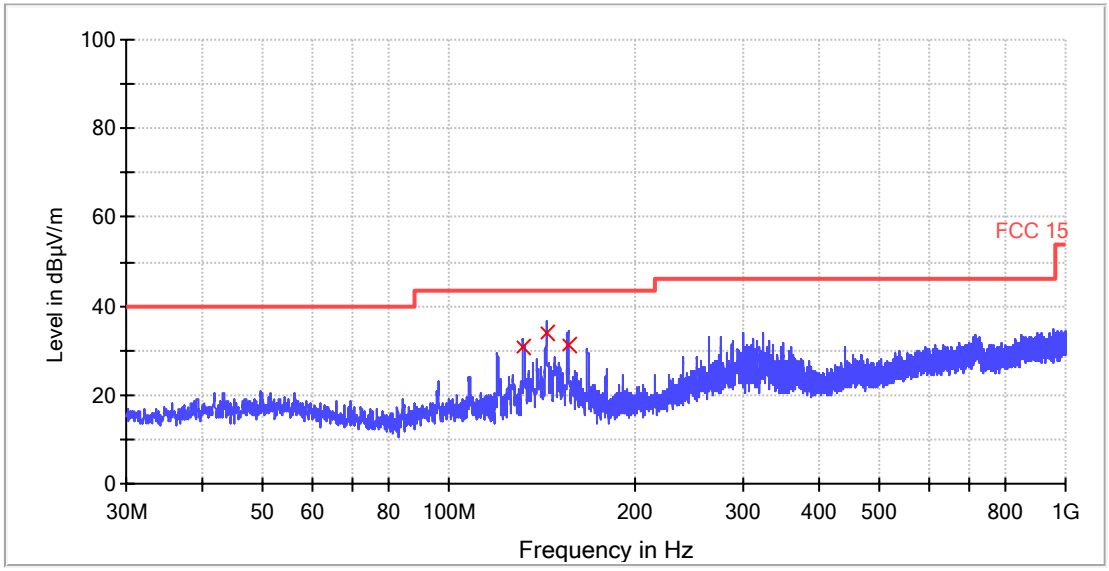
1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

TEST REPORT

Operation Frequency: 2440MHz

Operation Mode: Continuously transmitting

Horizontal



QP

Frequency (MHz)	Quasi Peak (dBµV/m)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
132.080000	30.8	120.000	H	9.9	12.7	43.5
144.040000	33.8	120.000	H	9.8	9.7	43.5
156.080000	31.3	120.000	H	10.2	12.2	43.5

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

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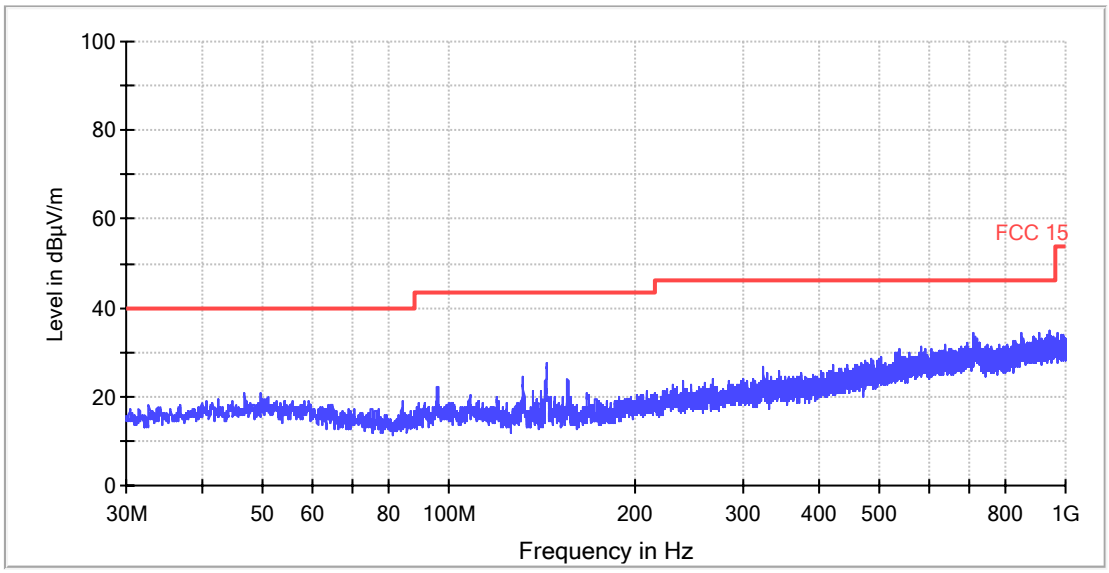
Operation Frequency: 2440MHz

Operation Mode: Continuously transmitting

Vertical



All emission levels are more than 6 dB below the limit.

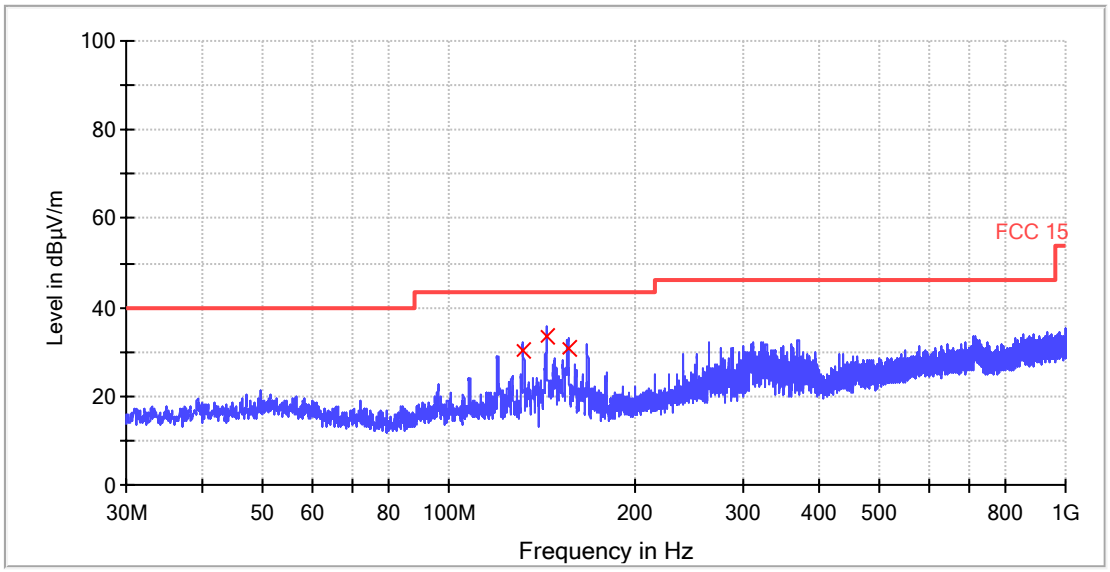
1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

TEST REPORT

Operation Frequency: 2480MHz

Operation Mode: Continuously transmitting

Horizontal



QP

Frequency (MHz)	Quasi Peak (dBµV/m)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
132.080000	30.3	120.000	H	9.9	13.2	43.5
143.960000	33.7	120.000	H	9.8	9.8	43.5
156.040000	31.0	120.000	H	10.2	12.5	43.5

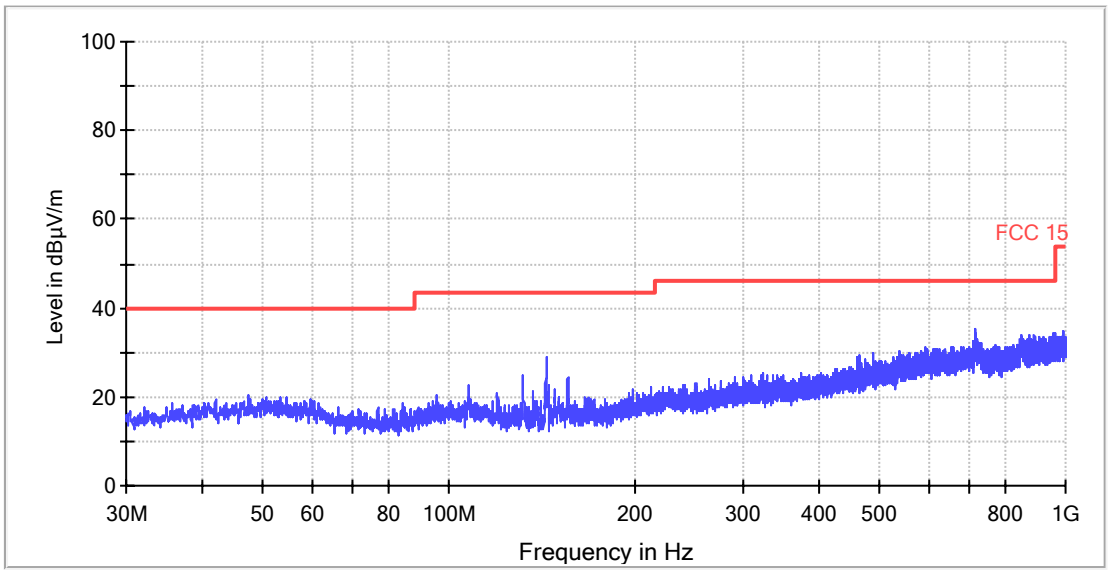
1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

TEST REPORT

Operation Frequency: 2480MHz

Operation Mode: Continuously transmitting

Vertical



All emission levels are more than 6 dB below the limit.

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB) + Read Level (dBµV)
3. Margin (dB) = Limit QPK (dBµV/m) –Quasi Peak (dBµV/m)

TEST REPORT

Radiated Emissions (Above 1GHz)

Operation Frequency: 2402MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dBμV)	Correction factors (dB/m)	PK Emission Level (dBμV/m)	PK Limit (dBμV/m)	Antenna polarization
2401.70	93.5	-8.1	85.4	114	Horizontal
4803.75	51.4	-1.1	50.3	74	Horizontal
2402.13	90.9	-8.1	82.8	114	Vertical
4803.75	46.8	-1.1	45.7	74	Vertical

AV Measurement:

Frequency (MHz)	AV Reading Level (dBμV)	Correction factors (dB/m)	AV Emission Level (dBμV/m)	AV Limit (dBμV/m)	Antenna polarization
2401.70	/	-8.1	/	94	Horizontal
4803.75	/	-1.1	/	54	Horizontal
2402.13	/	-8.1	/	94	Vertical
4803.75	/	-1.1	/	54	Vertical

Operation Frequency: 2440MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dBμV)	Correction factors (dB/m)	PK Emission Level (dBμV/m)	PK Limit (dBμV/m)	Antenna polarization
2440.03	93.2	-8.0	85.2	114	Horizontal
4880.25	49.9	-1.0	48.9	74	Horizontal
2440.10	91.5	-8.0	83.5	114	Vertical
4878.13	47.9	-1.0	46.9	74	Vertical

AV Measurement:

Frequency (MHz)	AV Reading Level (dBμV)	Correction factors (dB/m)	AV Emission Level (dBμV/m)	AV Limit (dBμV/m)	Antenna polarization
2440.03	/	-8.0	/	94	Horizontal
4880.25	/	-1.0	/	54	Horizontal
2440.10	/	-8.0	/	94	Vertical
4878.13	/	-1.0	/	54	Vertical

TEST REPORT

Operation Frequency: 2480MHz:

PK Measurement:

Frequency (MHz)	PK Reading Level (dBμV)	Correction factors (dB/m)	PK Emission Level (dBμV/m)	PK Limit (dBμV/m)	Antenna polarization
2480.13	98.4	-7.8	90.6	114	Horizontal
4958.88	44.9	-0.9	44.0	74	Horizontal
2480.08	96.4	-7.8	88.6	114	Vertical
4958.88	45.4	-0.9	44.5	74	Vertical

AV Measurement:

Frequency (MHz)	AV Reading Level (dBμV)	Correction factors (dB/m)	AV Emission Level (dBμV/m)	AV Limit (dBμV/m)	Antenna polarization
2480.13	/	-7.8	/	94	Horizontal
4958.88	/	-0.9	/	54	Horizontal
2480.08	/	-7.8	/	94	Vertical
4958.88	/	-0.9	/	54	Vertical

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier.
The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Correction Factor

Correction Factor = Antenna Factor + Cable Loss –Preamplifier Factor.

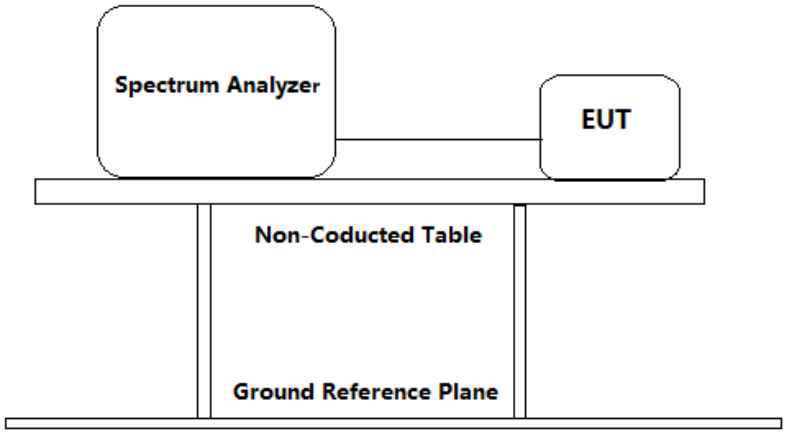
Notes:
1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
2. All measurements were made at 3 meter.
3. Horn antenna is used for the emission over 1000MHz.
4. When Peak emission level was below AV limit, the AV emission level did not be recorded.
5. Above 18GHz, no emissions had been detected.

TEST REPORT

4.4 Band Edges Requirement

Test Requirement:	FCC PART 15 C section 15.249 (d) (d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in§ 15.209, whichever is the lesser attenuation.
Frequency Band:	2400 MHz to 2483.5 MHz
Test Method:	ANSI C63.10: Clause 6.10
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The lowest, middle and the highest channels were selected for the final test as listed below.

Test Configuration:



Used Test Equipment List:
3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz）(RX), Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

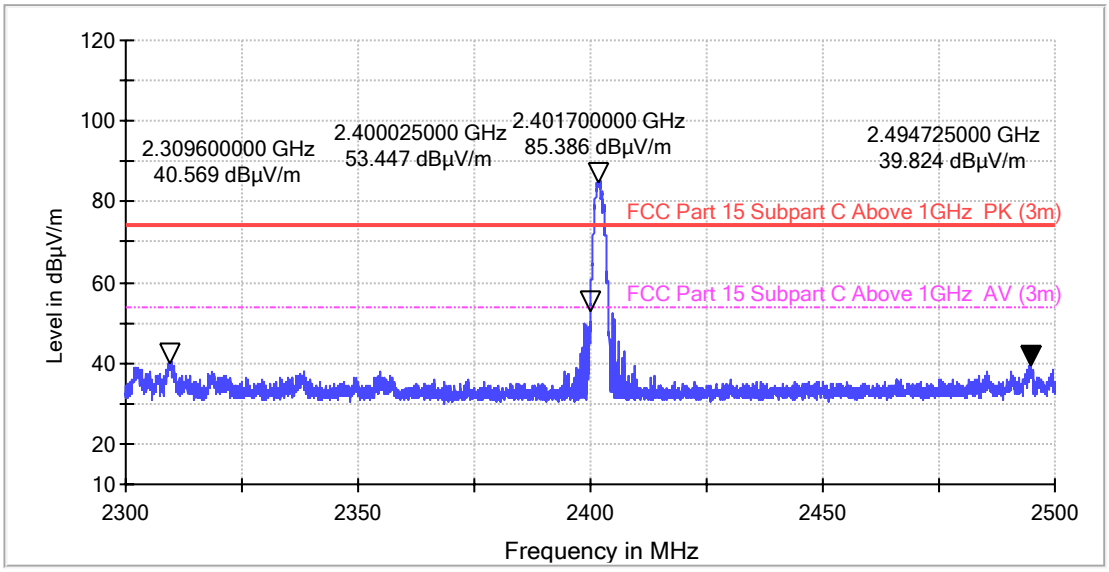
TEST REPORT

Test result with plots as follows:

Operation Frequency: 2402MHz

Operation Mode: Continuously transmitting

Horizontal



Frequency (MHz)	PK Reading Level (dBµV)	Correction factors (dB/m)	PK Emission Level (dBµV/m)	AV Limit (dBµV/m)
2309.60	49.0	-8.4	40.6	54.0
2400.03	61.5	-8.1	53.4	54.0
2494.73	47.6	-7.8	39.8	54.0

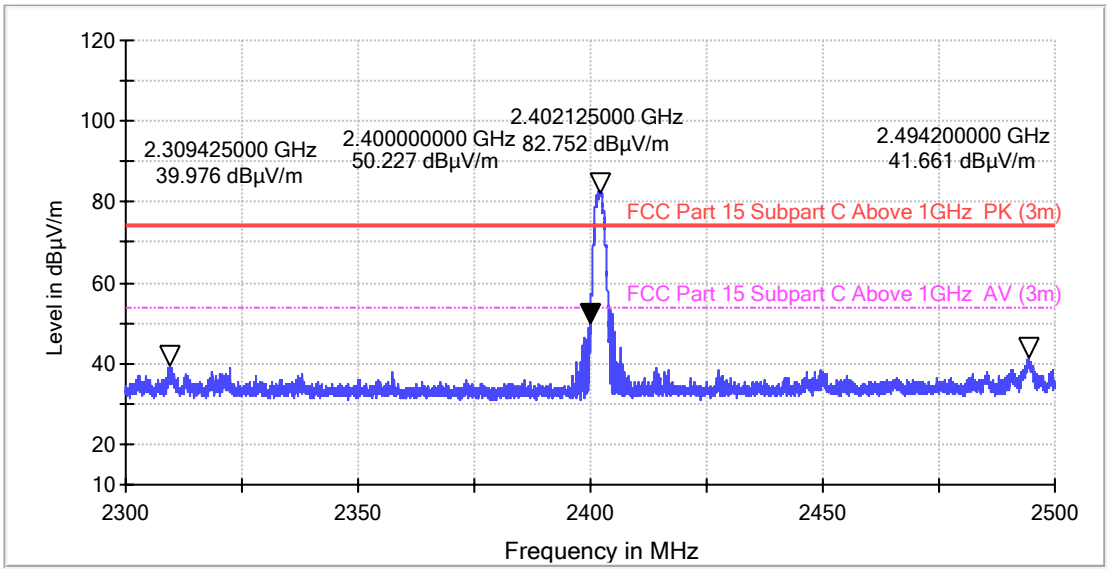
Remark:
Final Test Level =Receiver Reading + Correction Factor
Correction Factor = Antenna Factor + Cable Loss –Preamplifier Factor.
When Peak emission level was below AV limit, the AV emission level did not be recorded.

TEST REPORT

Operation Frequency: 2402MHz

Operation Mode: Continuously transmitting

Vertical



Frequency (MHz)	PK Reading Level (dBµV)	Correction factors (dB/m)	PK Emission Level (dBµV/m)	AV Limit (dBµV/m)
2309.43	48.3	-8.4	40.0	54.0
2400.00	58.3	-8.1	50.2	54.0
2494.20	49.5	-7.8	41.7	54.0

Remark:

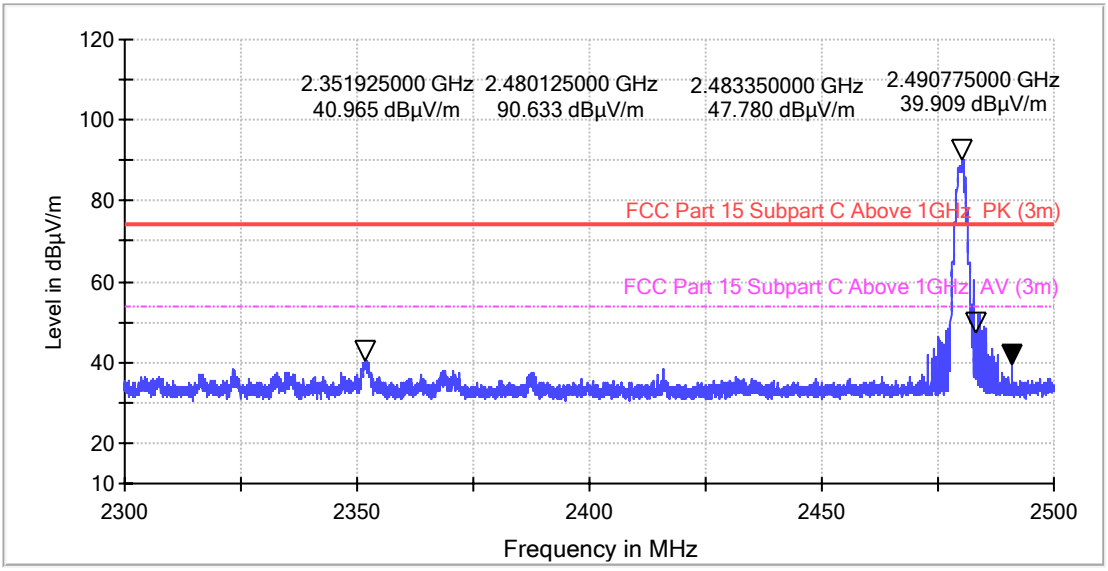
Final Test Level =Receiver Reading + Correction Factor

Correction Factor = Antenna Factor + Cable Loss –Preamplifier Factor.

When Peak emission level was below AV limit, the AV emission level did not be recorded.

TEST REPORT

Operation Frequency: 2480MHz
Operation Mode: Continuously transmitting
Horizontal

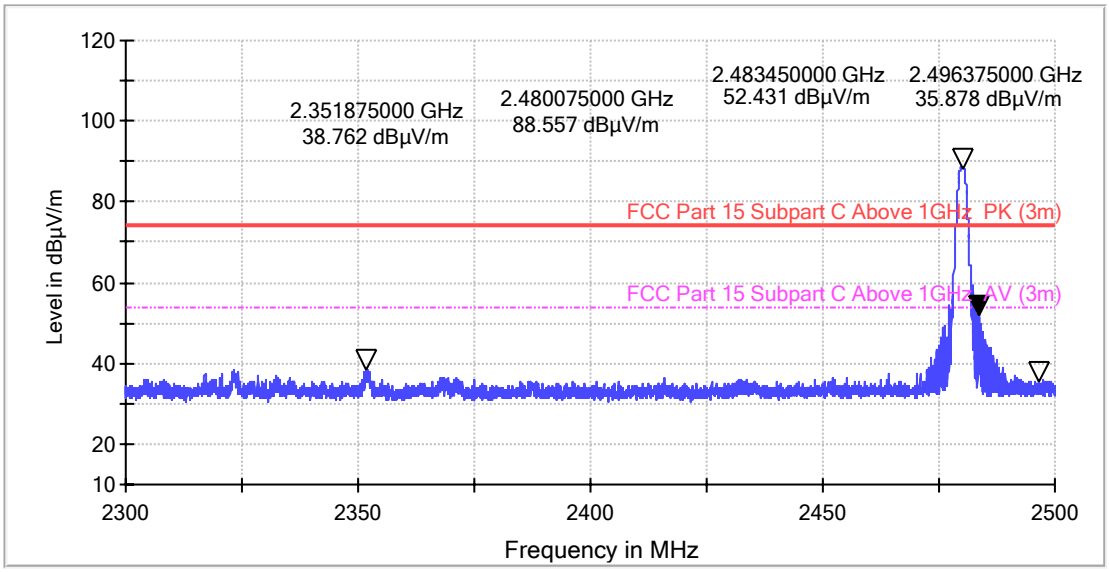


Frequency (MHz)	PK Reading Level (dBµV)	Correction factors (dB/m)	PK Emission Level (dBµV/m)	AV Limit (dBµV/m)
2351.93	49.3	-8.3	41.0	54.0
2483.35	55.6	-7.8	47.8	54.0
2490.78	47.7	-7.8	39.9	54.0

Remark:
Final Test Level =Receiver Reading + Correction Factor
Correction Factor = Antenna Factor + Cable Loss –Preamplifier Factor.
When Peak emission level was below AV limit, the AV emission level did not be recorded.

TEST REPORT

Operation Frequency: 2480MHz
Operation Mode: Continuously transmitting
Vertical



Frequency (MHz)	PK Reading Level (dBµV)	Correction factors (dB/m)	PK Emission Level (dBµV/m)	AV Limit (dBµV/m)
2351.88	47.1	-8.3	38.8	54.0
2483.45	60.2	-7.8	52.4	54.0
2496.38	43.7	-7.8	35.9	54.0

Remark:
Final Test Level =Receiver Reading + Correction Factor
Correction Factor = Antenna Factor + Cable Loss –Preamplifier Factor.
When Peak emission level was below AV limit, the AV emission level did not be recorded.

4.5 Conducted Emissions at Mains Terminals

Test result: Not Applicable.

TEST REPORT

5.0 Test Equipment List

Radiated Emission/Radio

Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM030-04	3m Semi-Anechoic Chamber	9×6×6 m^3	ETS‧LINDGREN	4/10/2021	1Y
EM031-02	EMI Test Receiver (9 kHz~7 GHz)	R&S ESR7	R&S	10/22/2020	1Y
EM031-03	Signal and Spectrum Analyzer (10 Hz~40 GHz)	R&S FSV40	R&S	9/6/2021	1Y
EM011-04	Loop antenna (9 kHz-30 MHz)	HFH2-Z2	R&S	6/18/2021	1Y
EM061-03	TRILOG Super Broadband test Antenna (30 MHz-1.5 GHz）(TX)	VULB 9161	SCHWARZBECK	6/18/2021	1Y
EM033-01	TRILOG Super Broadband test Antenna(30 MHz-3 GHz）(RX)	VULB 9163	SCHWARZBECK	9/19/2020	1Y
EM033-02	Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX)	R&S HF907	R&S	6/18/2021	1Y
EM033-03	High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX)	R&S SCU-26	R&S	4/24/2021	1Y
EM033-04	High Frequency Antenna & preamplifier (26 GHz-40 GHz)	R&S SCU-40	R&S	4/24/2021	1Y
EM031-02-01	Coaxial cable(9 kHz-1 GHz)	N/A	R&S	4/12/2021	1Y
EM033-02-02	Coaxial cable(1 GHz-18 GHz)	N/A	R&S	4/12/2021	1Y
EM033-04-02	Coaxial cable(18 GHz~40 GHz)	N/A	R&S	4/24/2021	1Y
EM031-01	Signal Generator (9 kHz~6 GHz)	SMB100A	R&S	7/22/2021	1Y
EM040-01	Band Reject/Notch Filter	WRHFV	Wainwright	N/A	1Y
EM040-02	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM040-03	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM022-03	2.45 GHz Filter	BRM50702	Micro-Tronics	5/10/2021	1Y
SA016-16	Programmable Temperature & Humidity Test Chamber	MHU-800LJ	TERCHY	10/13/2020	1Y
SA016-22	Climatic Test Chamber	C7-1500	Vötsch	11/10/2020	1Y
SA012-74	Digital Multimeter	FLUKE175	FLUKE	10/13/2020	1Y
EM010-01	Regulated DC Power supply	PAB-3003A	GUANHUA	N/A	1Y
SA040-22	Regulated DC Power supply	IT6721	ITECH	9/6/2021	1Y
EM084-06	Audio Analyzer	8903B	HP	4/15/2021	1Y
EM045-01-01	EMC32 software (RE/RS)	V10.01.00	R&S	N/A	N/A
EM045-01-09	EMC32 software (328/893)	V9.26.01	R&S	N/A	N/A

Conducted emission at the mains terminals

Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM080-05	EMI receiver	ESCI	R&S	7/19/2021	1Y
EM006-05	LISN	ENV216	R&S	6/7/2021	1Y
EM006-06	LISN	ENV216	R&S	9/6/2021	1Y
EM006-06-01	Coaxial cable	/	R&S	4/12/2021	1Y
EM004-04	EMC shield Room	8m×3m×3m	Zhongyu	1/5/2021	1Y

**********End of the test report**********