EUROFINS ELECTRICAL TESTING SERVICE (SHENZHEN) CO., LTD.

RADIO TEST - REPORT

FCC Compliance Test Report for

Product name: Mod Dock Circa / Mod Dock Banda

Model name: GS-VSN1/GS-VSN2

FCC ID: 2AXJN-1229020GS

Test Report Number: EFGX20090090-IE-01-E01

The above sample(s) and sample information was/were submitted and identified on behalf of the applicant.
Eurofins assures objectivity and impartiality of the test, and fulfills the obligation of confidentiality for applicant's commercial information and technical documents.

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1 General Information

1.1 Notes

The results of this test report relate exclusively to the item tested as specified in chapter “Description of test item” and are not transferable to any other test items.
Eurofins Electrical Testing Service (Shenzhen) Co., Ltd. is not responsible for any generalisations and conclusions drawn from this report. Any modification of the test item can lead to invalidity of test results and this test report may therefore be not applicable to the modified test item.
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Operator:

2021-03-03		Bruce Zheng / Project Engineer	Bruce Zheng
Date	Eurofins-Lab.	Name / Title	Signature

Technical responsibility for area of testing:

2021-03-03		Tom Tian / Supervisor	Tom Tian
Date	Eurofins	Name / Title	Signature

1.2 Testing laboratory

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
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The Laboratory has passed the Accreditation by the American Association for Laboratory Accrediation (A2LA). The Accreditation number is 5376.01
The Laboratory has been listed by industry Canada to perform electromagnetic emission measurements, The CAB identifier is CN0088

1.3 Details of applicant

Name	:	Grain Spark LLC
Address	:	421 South Brookhurst Street Suite# 120 Suite #120 Anaheim, CA 92804 United States
Telephone	:	(714) 495-9777
Fax	:	N/A

1.4 Details of manufacturer

Name	:	Shenzhen Form Electronics Co, Ltd
Address	:	F4 BldgE Junfeng Science&Technology Park Le Zhujiao Village,Xixiang Town,Bao'an Dist,Shenzhen,China
Telephone	:	+86 15338707574
Fax	:	N/A

1.5 Application details

Date of receipt of application	:	2020-09-14
Date of receipt of test item	:	2020-09-14
Date of test	:	2020-09-14 to 2020-12-18
Date of issue		2021-03-03

1.6 Test item

Product type	:	Mod Dock Circa / Mod Dock Banda
Model name	:	GS-VSN1/GS-VSN2
Brand	:	Grain Spark
Serial number	:	N/A
Ratings	:	3.7V/2000mAh 18650 battery,5 Vdc input, 120V/60Hz AC adapter
Test voltage	:	120V/60Hz
FCC ID	:	2AXJN-1229020GS
Additional information	:	All 2 products (GS-VSN1/GS-VSN2) have the same Bluetooth module, so only needs to be tested once.

RadioTechnical data

Frequency range	:	2400-2483.5 MHz,
Radio Tech.	:	Classic Bluetooth
Frequency channel	:	79 Channels
Modulation	:	GFSK, π/4-DQPSK, 8-DPSK
Antenna type	:	PCB antenna
Antenna gain	:	-1 dBi

Radio module

Type	:	Classic Bluetooth
Model	:	AB5303
Manufacturer	:	Bluetrum

1.7 Test standards

Test Standards	
FCC Part 15 Subpart C August 18, 2020	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

Test Method

1: ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
2: ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices.
3: KDB558074 D01 15.247 Meas Guidance v05r02

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

or

The deviations as specified were ascertained in the course of the tests performed. ☐

2.2 Test environment

Ac line conducted

Enviroment Parameter	Temperature	Relative Humidity
101.2 kPa	24.2℃	57.3%

RF Conducted

Enviroment Parameter	Temperature	Relative Humidity
101.2 kPa	24.7℃	59.6%

Radiated

Enviroment Parameter	Temperature	Relative Humidity
101.2 kPa	24.3℃	52.7%

2.3 Measurement uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty in conducted measurements	1.96dB
Uncertainty for Conducted RF test	RF Power Conducted: 1.16dB Frequency test involved: 1.05×10-7 or 1%
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.46dB; Vertical: 4.54dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.42dB; Vertical: 4.41dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.63dB; Vertical: 4.62dB;

2.4 Test mode

Mode	Channel Number	Frequency [MHz]
Basic Rate GFSK	0	2402
	39	2441
	78	2480
EDR π/4-DQPSK	0	2402
	39	2441
	78	2480
EDR 8-DPSK	0	2402
	39	2441
	78	2480

2.5 Test equipment utilized

EQUIPMENT ID	EQUIPMENT NAME	MODEL NO.	CAL. DUE DATE
23-2-13-05	EMI Test Receiver	ESR3	2021-04-24
23-2-13-06	LISN	NNLK 8127 RC	2021-04-23
23-2-10-16	Attenuator	VTSD 9561-F	2021-04-24
23-2-13-12	Signal Analyzer	N9010B-544	2021-04-24
23-2-13-13	BT/WLAN Tester	CMW270	2021-04-23
23-2-13-14	Signal Generator	N5183B-520	2021-04-23
23-2-13-15	Vector Signal Generator	N5182B-506	2021-04-23
23-2-10-43	Switch and Control Unit	ERIT-E-JS0806-2	2021-06-17
23-2-10-44	DC power supply	E3642A	2021-06-03
23-2-10-45	temperature test chamber	SG-80-CC-2	2021-04-23
23-2-13-01	EMI Test Receiver	ESR7	2021-04-24
23-2-13-02	Signal Analyzer	N9020B-544	2021-04-24
23-2-12-01	Active Loop Antenna	FMZB 1519B	2021-05-13
23-2-12-02	TRILOG Broadband Antenna	VULB9168	2021-04-27
23-2-12-03	Horn Antenna	3117	2021-05-11
23-2-12-04	Horn Antenna	BBHA 9170	2021-05-11
23-2-12-05	Universal Antenna Stand	CLSA0110	2021-05-11
23-2-10-01	Preamplifier	BBV9745	2021-04-23
23-2-10-02	Preamplifier	TAP01018048	2021-04-24
23-2-10-03	Preamplifier	TAP18040048	2021-04-24
23-2-10-14	Switch and Control Unit	ERIT-E-JS0806-SF1	N/A

2.6 Auxiliary Equipment Used during Test:

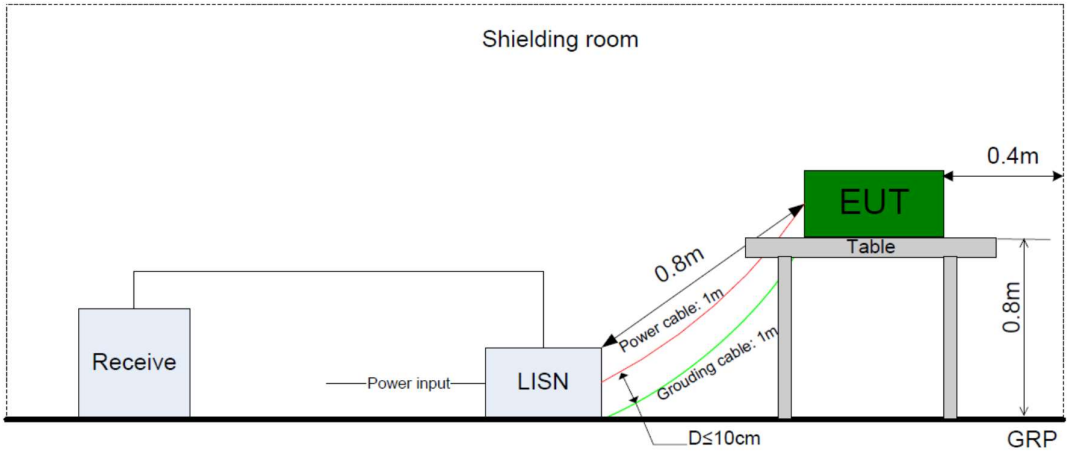
DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Laptop	LENOVO	TP00096A	PF-1QH0LV

2.7 Test software information:

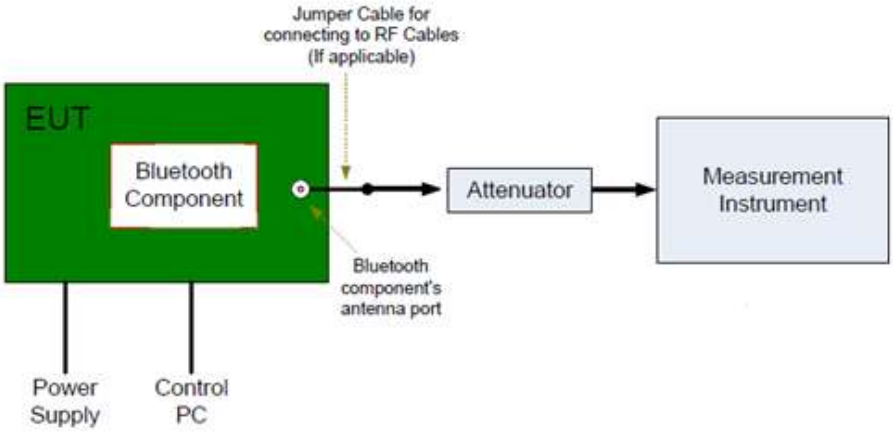
Test Software Version	BT_Tool V1.0.5	
Mode	Setting TX Power	TX Pattern
Basic Rate GFSK	7	PRBS
EDR π/4-DQPSK	7	PRBS
EDR 8-DPSK	7	PRBS

2.8 Test setup

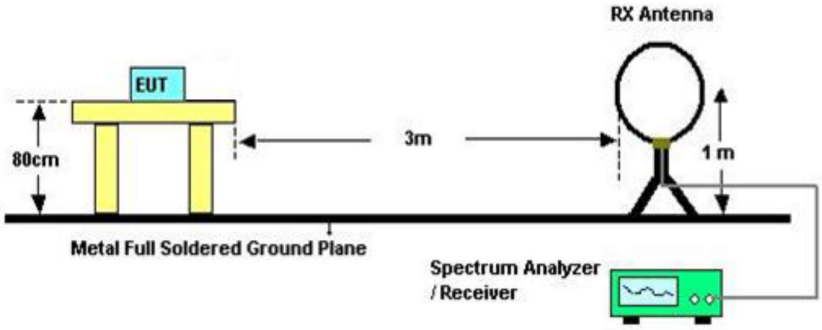
AC line conducted



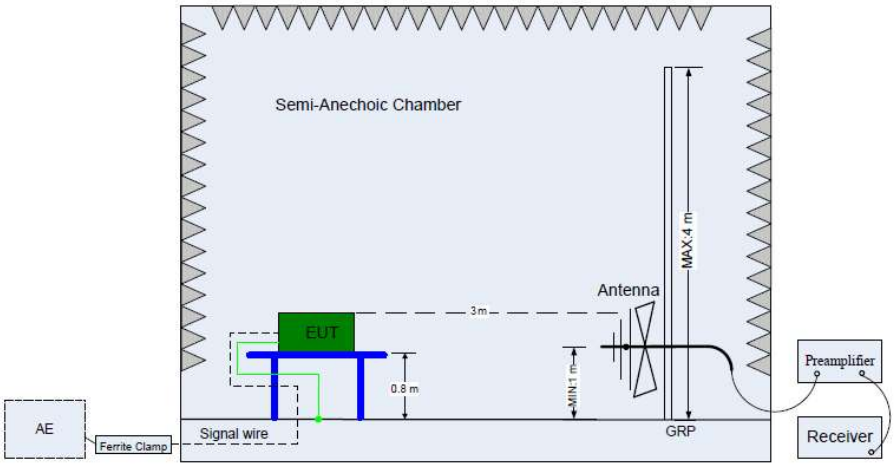
Conducted tests



Radiated tests below 30MHz

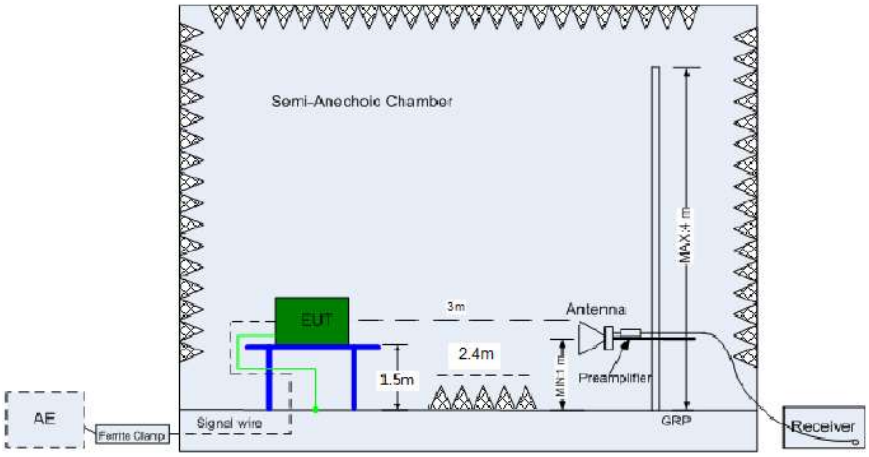


Radiated tests below 1GHz



(Below 1 GHz)

Setup diagram for radiated tests above 1GHz



(Above 1 GHz)

2.9 Test results

☒ 1st test ☐ test after modification ☐ production test

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Test Result	Verdict	Test Site
§15.207	Conducted emission AC power port	See Page 12	Pass	Site 1
§15.247(b)(1)	Peak Output Power for FHSS	Appendix C	Pass	Site 1
§15.247(b)(3)	Conducted output power for DTS	N/A	N/A	--
§15.247(e)	Power spectral density	N/A	N/A	--
§15.247(a)(2)	6dB bandwidth	N/A	N/A	--
§15.247(a)(1)	20dB Occupied bandwidth	Appendix A	Pass	Site 1
---	99% Occupied Bandwidth	Appendix B	Pass	Site 1
§15.247(a)(1)	Carrier frequency separation	Appendix D	Pass	Site 1
§15.247(a)(1)(iii)	Number of hopping frequencies	Appendix F	Pass	Site 1
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Appendix E	Pass	Site 1
§15.247(d) §15.205	Conducted Spurious Emissions	Appendix H	Pass	Site 1
§15.247(d)	Conducted Band-Edge	Appendix G	Pass	Site 1
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	See page 25	Pass	Site 1
---	Duty cycle	Appendix I	Pass	Site 1
§15.247(g) & §15.247(h)	Hopping sequence requirement	See page 50	Pass	Site 1
§15.203	Antenna requirement	See note 1	Pass	--

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses an PCB antenna, the gain: -1 dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

3 Technical Requirement

3.1 Conducted emission AC power port

Test Method:
The test method was refered to the subclause 6.2 of ANSI C63.10-2013.

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both Neutral and Live lines.

Limit:

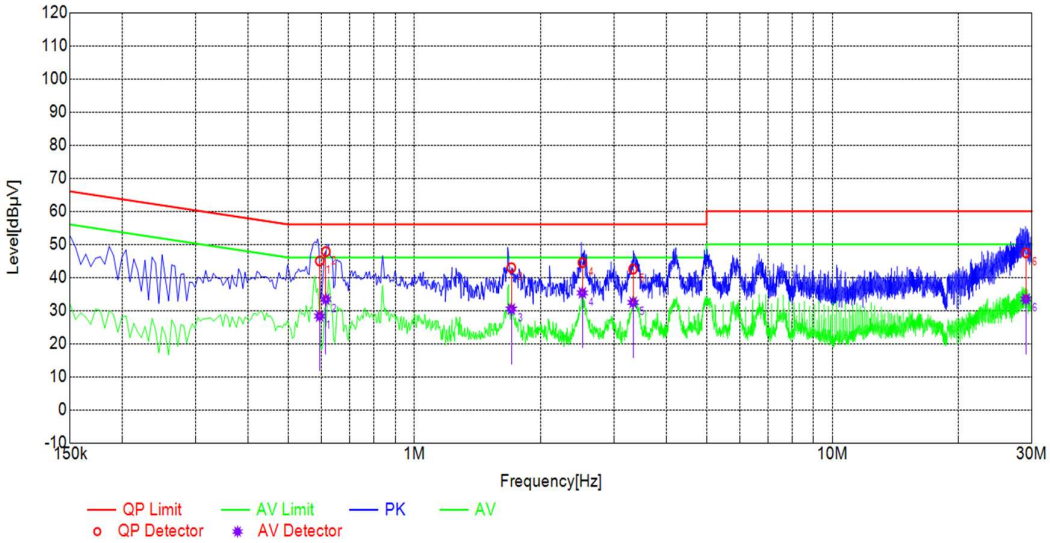
FCC §15.207 (a)

Frequency	QP Limit	AV Limit
MHz	dBµV	dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linear.

Test Result:
Worst case

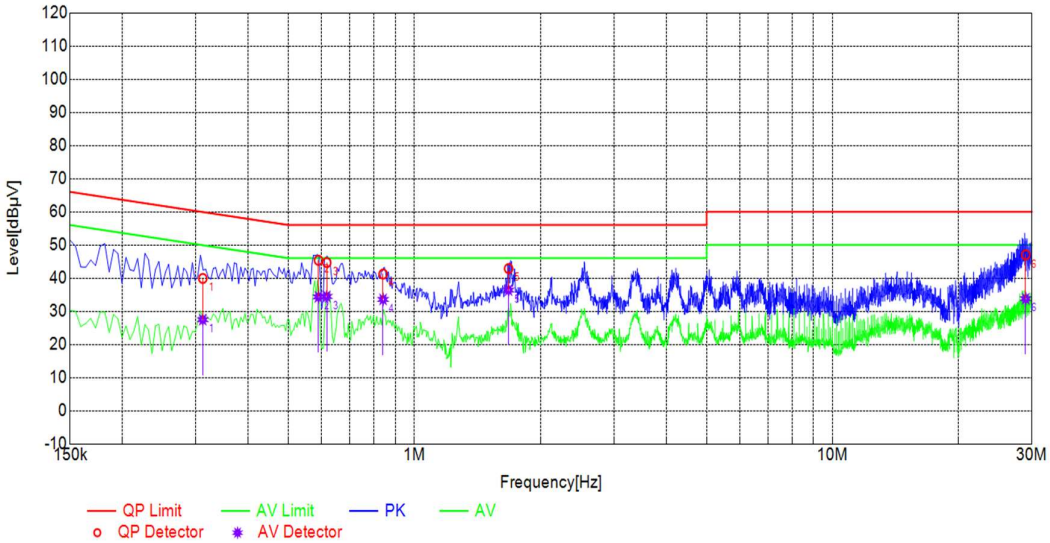
BT TX L



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.5930	0.22	44.97	56.00	11.03	28.34	46.00	17.66	PASS
0.6134	0.22	47.82	56.00	8.18	33.40	46.00	12.60	PASS
1.7047	0.25	42.96	56.00	13.04	30.45	46.00	15.55	PASS
2.5207	0.27	44.50	56.00	11.50	35.35	46.00	10.65	PASS
3.3339	0.27	42.56	56.00	13.44	32.45	46.00	13.55	PASS
29.0429	0.61	47.43	60.00	12.57	33.47	50.00	16.53	PASS

Note1 : Corrector factor = Attenuator loss + Cable Loss

BT TX N



Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
0.3114	0.22	39.91	59.93	20.02	27.47	49.93	22.46	PASS
0.5889	0.21	45.39	56.00	10.61	34.34	46.00	11.66	PASS
0.6165	0.22	44.68	56.00	11.32	34.48	46.00	11.52	PASS
0.8409	0.22	41.24	56.00	14.76	33.58	46.00	12.42	PASS
1.6788	0.25	42.88	56.00	13.12	36.40	46.00	9.60	PASS
28.9899	0.65	47.03	60.00	12.97	33.78	50.00	16.22	PASS

Note1 : Corrector factor = Attenuator loss + Cable Loss

3.2 Duty cycle

Test Method:
The test method was refered to the subclause 11.6 of ANSI C63.10-2013.

Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

a) A diode detector and an oscilloscope that together have a sufficiently short response time to permit accurate measurements of the ON and OFF times of the transmitted signal.

b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:

   1) Set the center frequency of the instrument to the center frequency of the transmission.

   2) Set RBW ≧ OBW if possible; otherwise, set RBW to the largest available value.

   3) Set VBW ≧ RBW. Set detector = peak or average.

   4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/*T* and the number of sweep points across duration *T* exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if *T* ≤16.7 μs.)

Limit:

None; for reporting purposes only.

3.3 20dB Occupied bandwidth

Test Method:
The test method was refered to the subclause 6.9.2 of ANSI C63.10-2013.

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.

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 shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d) Steps a) through c) might require iteration to adjust within the specified tolerances.

e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.

f) Set detection mode to peak and trace mode to max hold.

g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "íxx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "íxx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Limit:

None; for reporting purposes only.

3.4 99% Occupied Bandwidth

Test Method:
The test method was refered to the subclause 6.9.3 of ANSI C63.10-2013.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

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 shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d) Step a) through step c) might require iteration to adjust within the specified range.

e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Limit:

None; for reporting purposes only.

3.5 Carrier frequency separation

Test Method:
The test method was refered to the subclause 7.8.2 of ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Wide enough to capture the peaks of two adjacent channels.

b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

c) Video (or average) bandwidth (VBW) ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

g) Allow the trace to stabilize.

Limit:

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Result: Pass

3.6 Number of hopping frequencies

Test Method:
The test method was refered to the subclause 7.8.3 of ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

c) VBW ≥ RBW.

d) Sweep: Auto.

e) Detector function: Peak.

f) Trace: Max hold.

g) Allow the trace to stabilize.

Limit:

FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Result: Pass

3.7 Time of occupancy (dwell time)

Test Method:
The test method was refered to the subclause 7.8.4 of ANSI C63.10-2013.

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be ≦ channel spacing and where possible RBW should be set >> 1 / *T*, where *T* is the expected dwell time per channel.

c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

d) Detector function: Peak.

e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

Limit:

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Result: Pass

3.8 Peak Output Power

Test Method:
The test method was refered to the subclause 7.8.5 of ANSI C63.10-2013.

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:
   1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
   2) RBW > 20 dB bandwidth of the emission being measured.
   3) VBW ≧ RBW.
   4) Sweep: Auto.
   5) Detector function: Peak.
   6) Trace: Max hold.
b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

Limits:

§15.247 (b) (1)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels.

Test Result: Pass

3.9 Conducted Band-edge & Spurious Emissions

Test Method:
The test method was refered to the subclause 7.8.6 & 7.8.8 of ANSI C63.10-2013.

The transmitter output is connected to a spectrum analyzer.The resolution bandwidth is set to 100 kHz.The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

Limit:

FCC §15.247 (d)

Limit = -20 dBc

Test Result: Pass

3.10 Radiated emissions for transmitter

Test Method:
Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4
Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5
Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6
Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3: 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.
4: 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.
5: Use the following spectrum analyzer settings According to C63.10:
For Above 1GHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
For Below 1GHz
Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.
For Below 30MHz
Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 200 Hz, VBW≥RBW from 9KHz to 0.15MHz, RBW 9KHz VBW≥RBW from 0.15MHz to 30MHz for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:
1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
5: When duty cycle <98%, The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is VBW ≥ 1 / T, the T is transmission duration (T).

Limit:

FCC §15.205 and §15.209

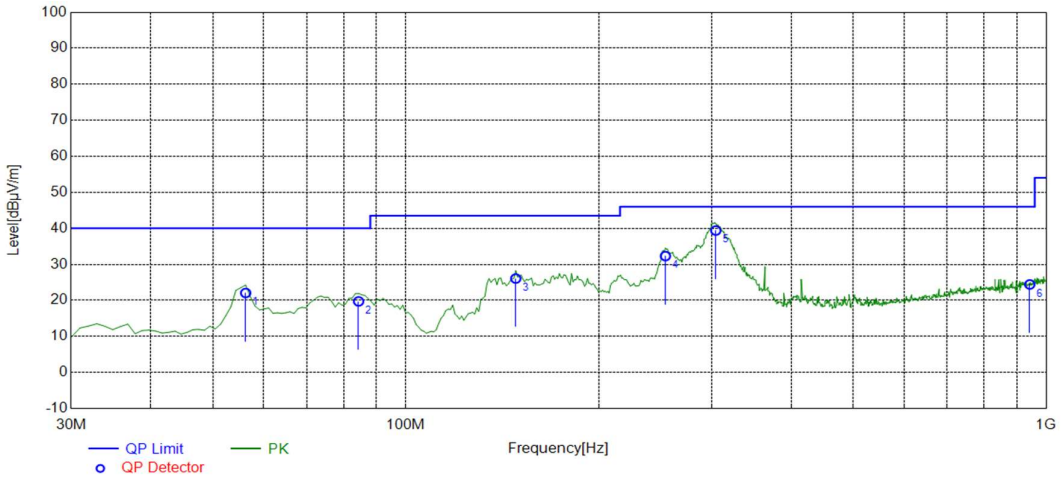
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

§15.205 Restricted bands of operation

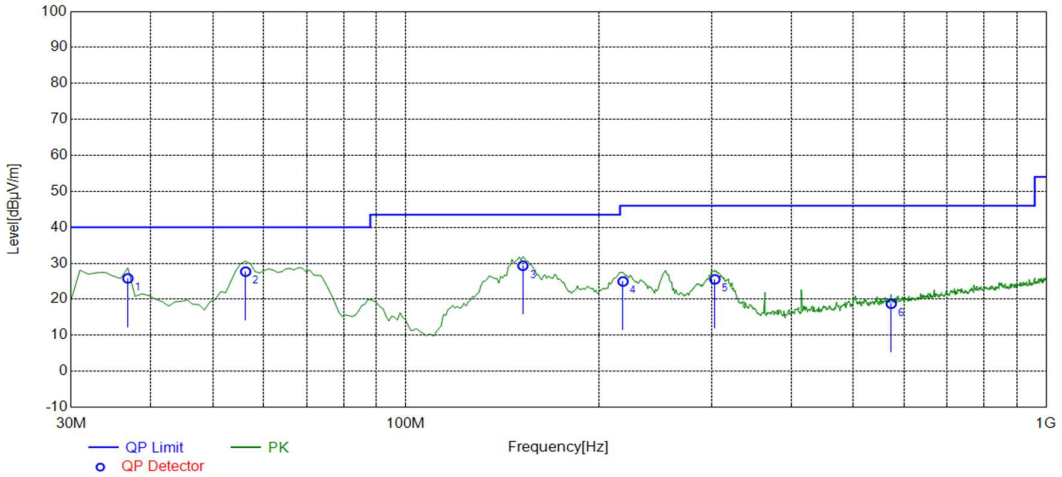
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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	
13.36-13.41			

Test Result:
Spurious radiated emissions (Radiated)
GFSK Modulation 2402MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
56.2162	-16.14	22.06	40.00	17.94	200	262	Horizontal
84.3744	-20.04	19.73	40.00	20.27	200	248	Horizontal
148.4585	-14.83	26.08	43.50	17.42	200	98	Horizontal
254.2943	-16.92	32.31	46.00	13.69	100	317	Horizontal
304.7848	-15.21	39.40	46.00	6.60	100	197	Horizontal
942.7127	-4.98	24.44	46.00	21.56	100	191	Horizontal



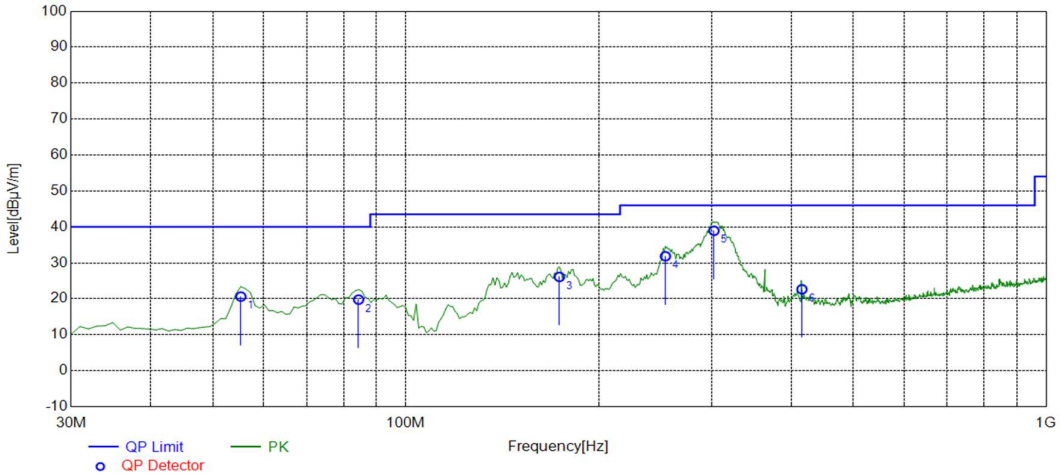
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
36.7968	-17.11	25.81	40.00	14.19	100	58	Vertical
56.2162	-16.14	27.68	40.00	12.32	100	136	Vertical
152.3423	-14.81	29.33	43.50	14.17	100	200	Vertical
218.3684	-17.91	24.96	46.00	21.04	100	184	Vertical
303.8138	-15.22	25.56	46.00	20.44	100	167	Vertical
572.7728	-9.96	18.77	46.00	27.23	100	202	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

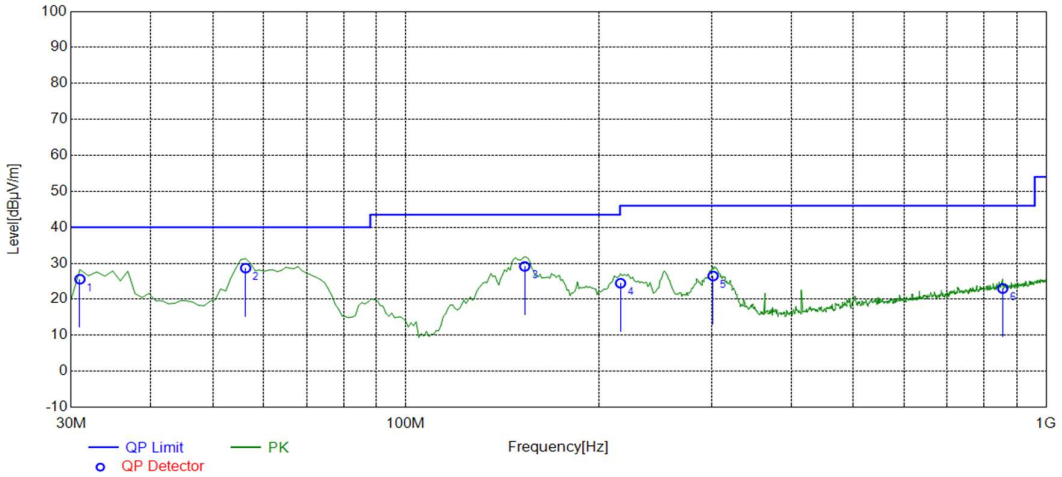
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	9607.9054	-8.74	60.37	74.00	13.63	PK	Horizontal	Pass
	9607.9054	-8.74	51.16	54.00	2.84	AV	Horizontal	Pass
	4804.3005	-14.77	57.66	74.00	16.34	PK	Vertical	Pass
	4804.3005	-14.77	46.01	54.00	7.99	AV	Vertical	Pass

GFSK Modulation 2441MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	20.63	40.00	19.37	200	228	Horizontal
84.3744	-20.04	19.79	40.00	20.21	200	252	Horizontal
173.7037	-15.78	26.11	43.50	17.39	200	91	Horizontal
254.2943	-16.92	31.85	46.00	14.15	100	289	Horizontal
302.8428	-15.23	38.94	46.00	7.06	100	2	Horizontal
415.4755	-13.24	22.66	46.00	23.34	100	280	Horizontal



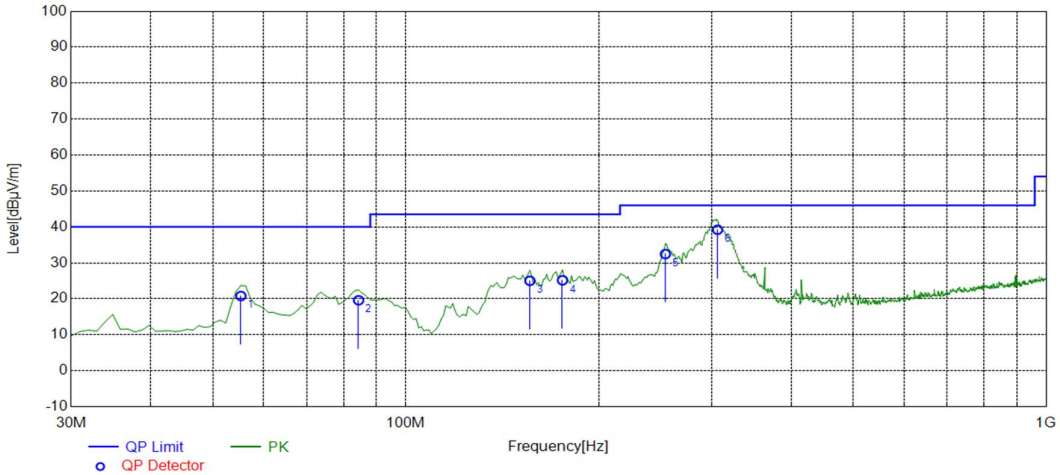
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
30.9710	-18.36	25.59	40.00	14.41	100	190	Vertical
56.2162	-16.14	28.67	40.00	11.33	100	180	Vertical
153.3133	-14.84	29.15	43.50	14.35	100	181	Vertical
216.4264	-17.96	24.46	46.00	21.54	100	225	Vertical
301.8719	-15.24	26.48	46.00	19.52	100	154	Vertical
855.3253	-6.03	23.00	46.00	23.00	100	303	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

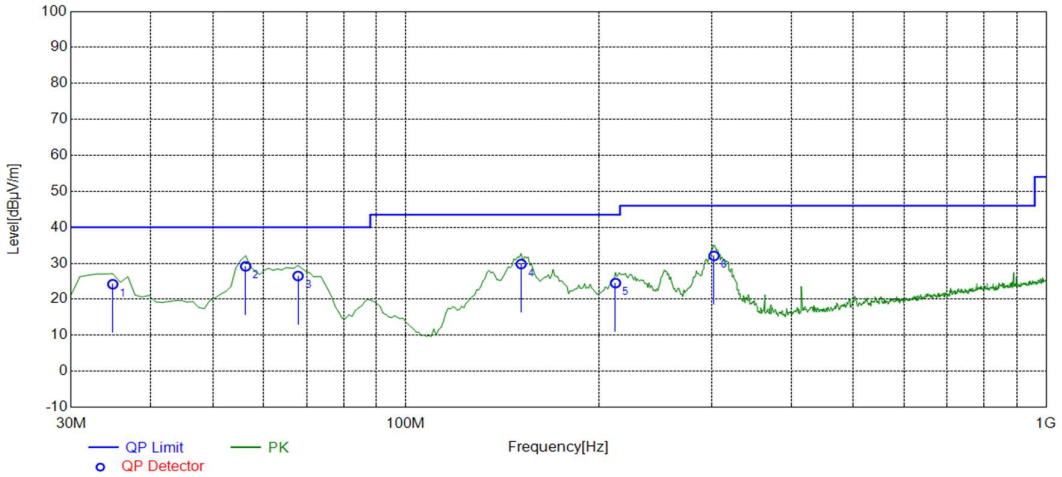
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4882.3167	-14.86	60.22	74.00	13.78	PK	Horizontal	Pass
	4882.3167	-14.86	51.31	54.00	2.69	AV	Horizontal	Pass
	4881.6867	-14.86	56.58	74.00	17.42	PK	Vertical	Pass
	4881.6867	-14.86	47.14	54.00	6.86	AV	Vertical	Pass

GFSK Modulation 2480MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	20.80	40.00	19.20	200	247	Horizontal
84.3744	-20.04	19.61	40.00	20.39	200	234	Horizontal
156.2262	-14.95	25.01	43.50	18.49	200	108	Horizontal
175.6456	-16.04	25.16	43.50	18.34	200	106	Horizontal
254.2943	-16.92	32.46	46.00	13.54	100	292	Horizontal
306.7267	-15.19	39.23	46.00	6.77	100	15	Horizontal



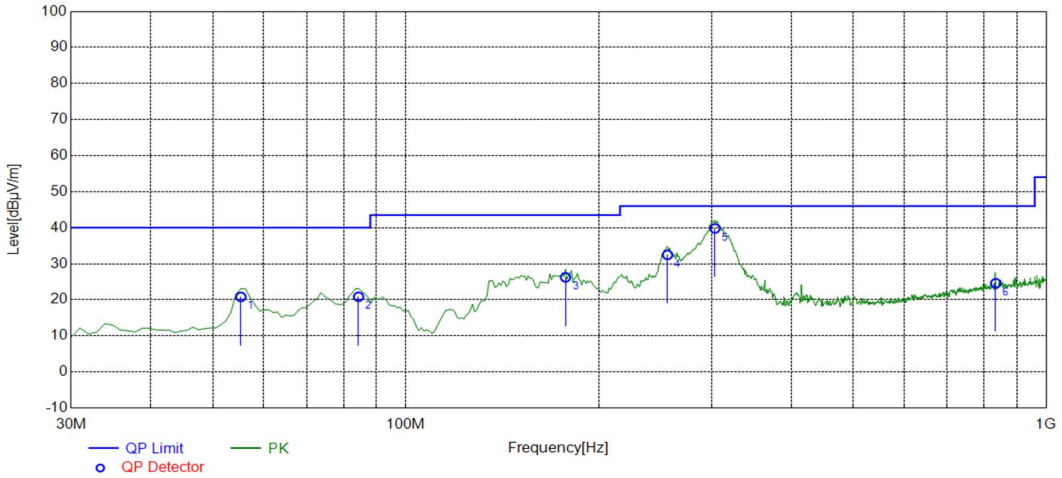
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
34.8549	-17.53	24.19	40.00	15.81	100	260	Vertical
56.2162	-16.14	29.17	40.00	10.83	100	171	Vertical
67.8679	-18.27	26.48	40.00	13.52	100	218	Vertical
151.3714	-14.77	29.81	43.50	13.69	100	13	Vertical
212.5425	-18.06	24.51	43.50	18.99	100	132	Vertical
302.8428	-15.23	32.07	46.00	13.93	100	13	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

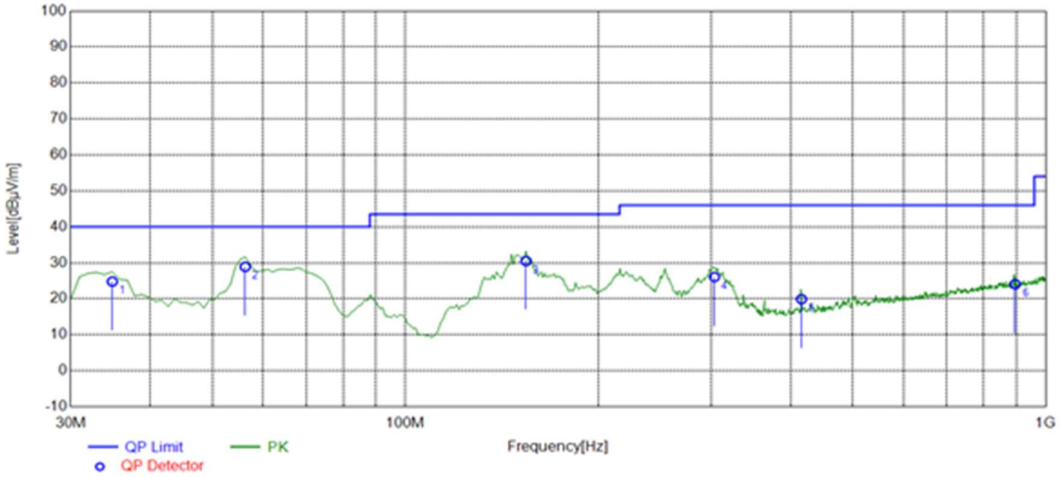
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4959.6992	-14.58	60.60	74.00	13.40	PK	Horizontal	Pass
	4959.6992	-14.58	51.46	54.00	2.54	AV	Horizontal	Pass
	4959.6892	-14.58	59.16	74.00	14.84	PK	Vertical	Pass
	4959.6892	-14.58	48.81	54.00	5.19	AV	Vertical	Pass

π /4-DQPSK Modulation 2402MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	20.81	40.00	19.19	200	248	Horizontal
84.3744	-20.04	20.85	40.00	19.15	200	44	Horizontal
177.5876	-16.31	26.24	43.50	17.26	200	79	Horizontal
256.2362	-16.85	32.46	46.00	13.54	100	307	Horizontal
303.8138	-15.22	39.80	46.00	6.20	100	202	Horizontal
833.9640	-6.16	24.61	46.00	21.39	100	234	Horizontal



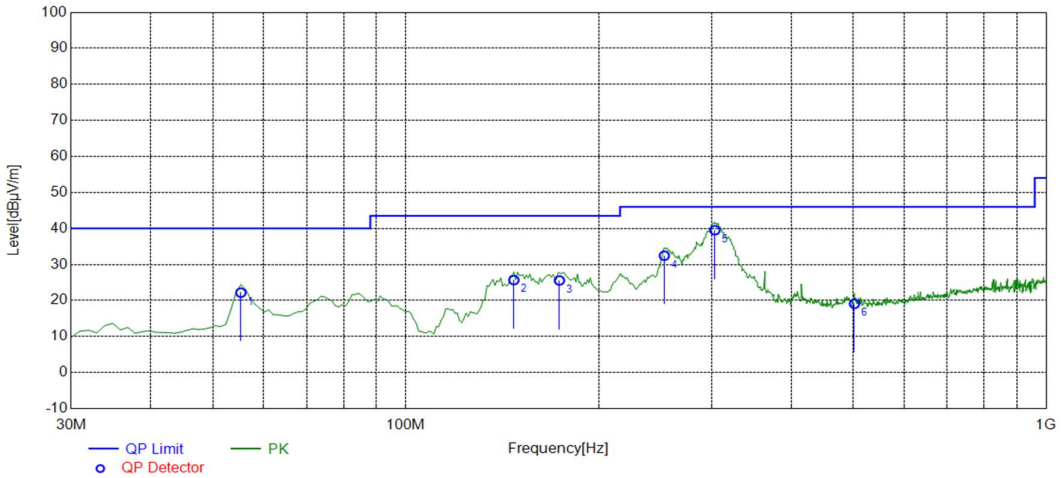
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
34.8549	-17.53	24.80	40.00	15.20	100	259	Vertical
56.2162	-16.14	28.91	40.00	11.09	100	104	Vertical
154.2843	-14.88	30.53	43.50	12.97	100	180	Vertical
303.8138	-15.22	26.07	46.00	19.93	100	153	Vertical
415.4755	-13.24	19.91	46.00	26.09	100	295	Vertical
896.1061	-5.71	24.08	46.00	21.92	100	257	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

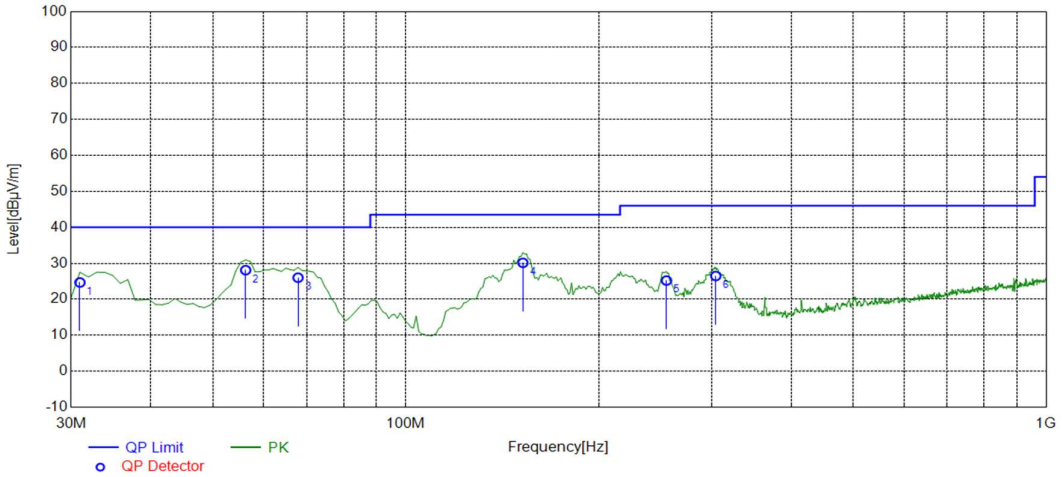
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4804.0405	-14.77	61.74	74.00	12.26	PK	Horizontal	Pass
	4804.0405	-14.77	49.71	54.00	4.29	AV	Horizontal	Pass
	4804.2505	-14.77	58.59	74.00	15.41	PK	Vertical	Pass
	4804.2505	-14.77	46.41	54.00	7.59	AV	Vertical	Pass

π /4-DQPSK Modulation 2441MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	22.19	40.00	17.81	200	250	Horizontal
147.4875	-14.90	25.68	43.50	17.82	200	100	Horizontal
173.7037	-15.78	25.57	43.50	17.93	200	66	Horizontal
253.3233	-16.95	32.45	46.00	13.55	100	283	Horizontal
303.8138	-15.22	39.52	46.00	6.48	100	203	Horizontal
501.8919	-11.41	19.10	46.00	26.90	200	43	Horizontal



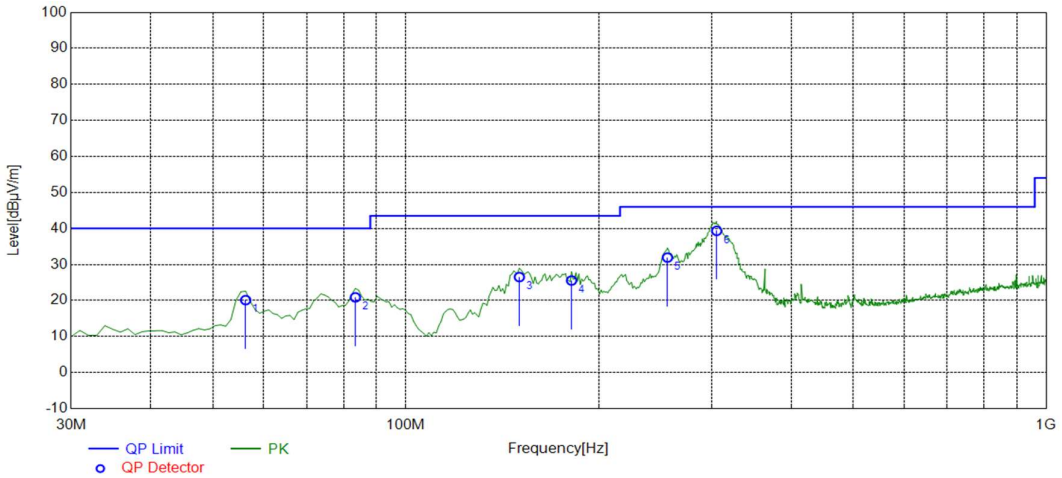
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
30.9710	-18.36	24.68	40.00	15.32	100	258	Vertical
56.2162	-16.14	28.11	40.00	11.89	100	118	Vertical
67.8679	-18.27	26.01	40.00	13.99	100	220	Vertical
152.3423	-14.81	30.14	43.50	13.36	100	360	Vertical
255.2653	-16.88	25.22	46.00	20.78	100	68	Vertical
304.7848	-15.21	26.48	46.00	19.52	100	335	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

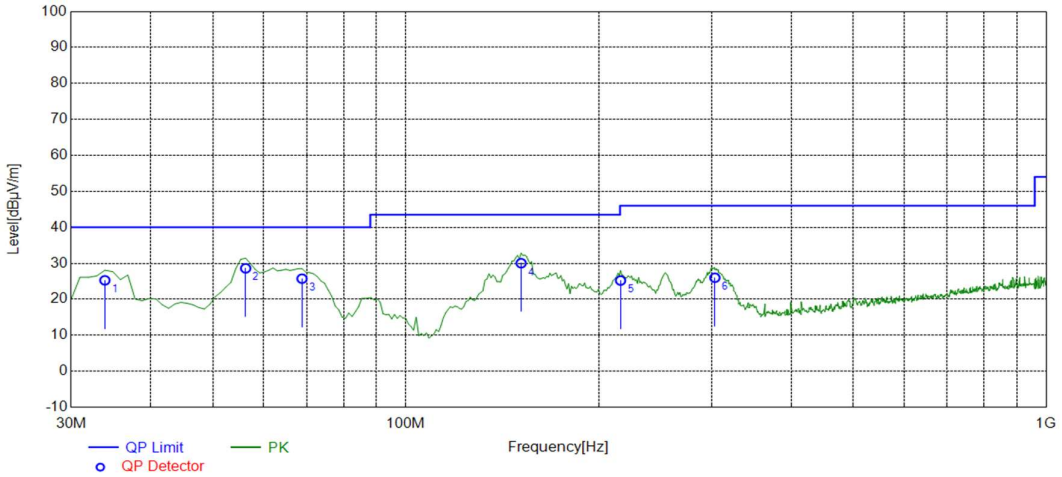
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4881.6817	-14.86	58.55	74.00	15.45	PK	Horizontal	Pass
	4881.6817	-14.86	49.99	54.00	4.01	AV	Horizontal	Pass
	4882.2217	-14.86	60.18	74.00	13.82	PK	Vertical	Pass
	4882.2217	-14.86	47.90	54.00	6.10	AV	Vertical	Pass

π /4-DQPSK Modulation 2480MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
56.2162	-16.14	20.13	40.00	19.87	200	238	Horizontal
83.4034	-19.90	20.89	40.00	19.11	200	231	Horizontal
150.4004	-14.73	26.52	43.50	16.98	200	100	Horizontal
181.4715	-16.73	25.56	43.50	17.94	100	78	Horizontal
256.2362	-16.85	31.93	46.00	14.07	100	291	Horizontal
305.7558	-15.20	39.35	46.00	6.65	100	195	Horizontal



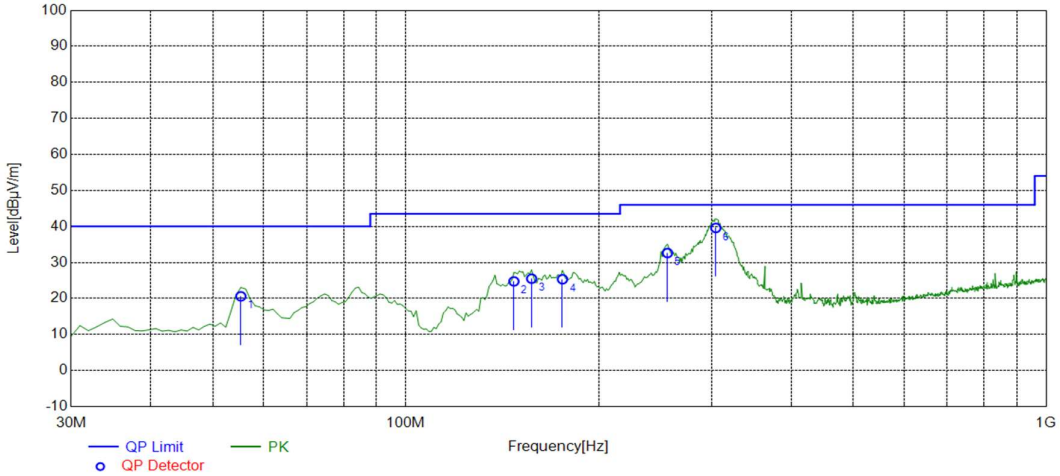
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
33.8839	-17.73	25.27	40.00	14.73	100	272	Vertical
56.2162	-16.14	28.61	40.00	11.39	100	152	Vertical
68.8388	-18.52	25.74	40.00	14.26	100	219	Vertical
151.3714	-14.77	30.04	43.50	13.46	100	42	Vertical
216.4264	-17.96	25.21	46.00	20.79	100	195	Vertical
303.8138	-15.22	25.99	46.00	20.01	100	162	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

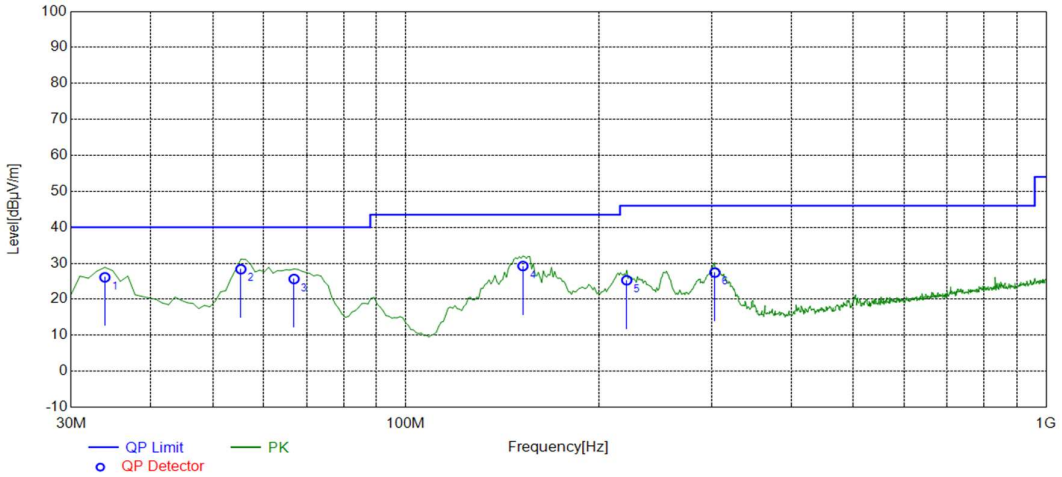
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4959.6992	-14.58	62.57	74.00	11.43	PK	Horizontal	Pass
	4959.6992	-14.58	50.70	54.00	3.30	AV	Horizontal	Pass
	4959.6892	-14.58	60.90	74.00	13.10	PK	Vertical	Pass
	4959.6892	-14.58	45.41	54.00	8.59	AV	Vertical	Pass

8-DPSK Modulation 2402MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	20.61	40.00	19.39	200	234	Horizontal
147.4875	-14.90	24.76	43.50	18.74	200	116	Horizontal
157.1972	-14.99	25.51	43.50	17.99	200	73	Horizontal
175.6456	-16.04	25.35	43.50	18.15	200	82	Horizontal
256.2362	-16.85	32.63	46.00	13.37	100	290	Horizontal
304.7848	-15.21	39.60	46.00	6.40	100	16	Horizontal



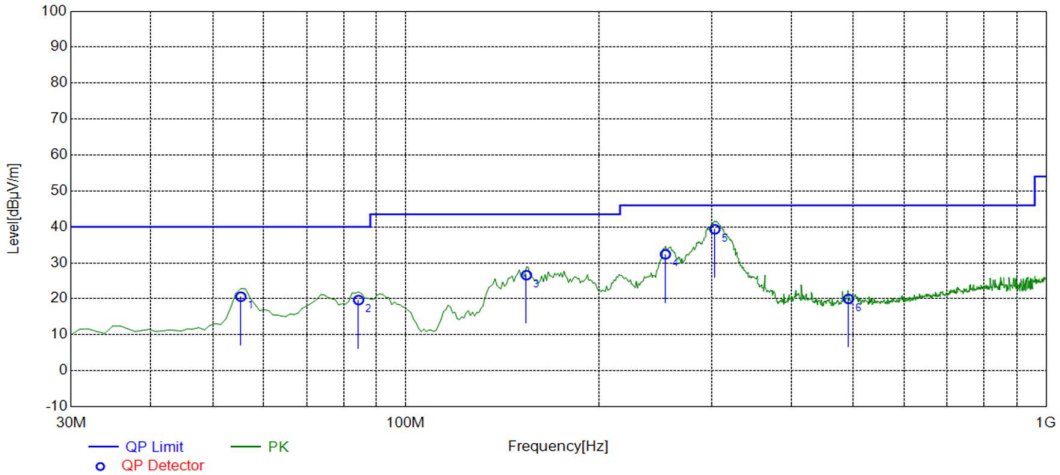
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
33.8839	-17.73	26.11	40.00	13.89	100	202	Vertical
55.2452	-16.11	28.36	40.00	11.64	100	148	Vertical
66.8969	-18.02	25.64	40.00	14.36	100	228	Vertical
152.3423	-14.81	29.25	43.50	14.25	100	200	Vertical
221.2813	-17.83	25.30	46.00	20.70	100	113	Vertical
303.8138	-15.22	27.43	46.00	18.57	100	167	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

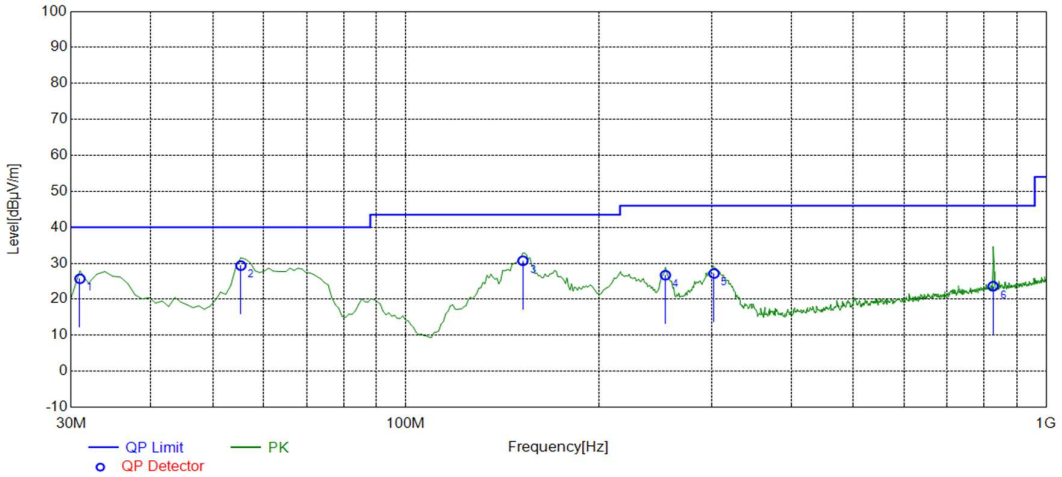
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4804.1205	-14.77	62.14	74.00	11.86	PK	Horizontal	Pass
	4804.1205	-14.77	49.54	54.00	4.46	AV	Horizontal	Pass
	4803.7805	-14.77	58.55	74.00	15.45	PK	Vertical	Pass
	4803.7805	-14.77	46.36	54.00	7.64	AV	Vertical	Pass

8-DPSK Modulation 2441MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	20.59	40.00	19.41	200	250	Horizontal
84.3744	-20.04	19.67	40.00	20.33	200	250	Horizontal
154.2843	-14.88	26.59	43.50	16.91	100	77	Horizontal
254.2943	-16.92	32.39	46.00	13.61	100	294	Horizontal
303.8138	-15.22	39.36	46.00	6.64	100	196	Horizontal
491.2112	-11.60	19.98	46.00	26.02	200	64	Horizontal



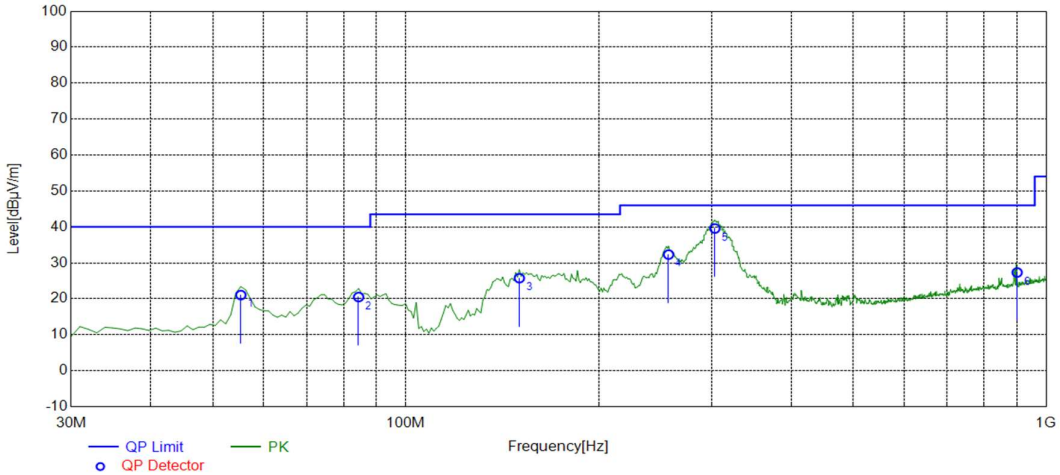
Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
30.9710	-18.36	25.71	40.00	14.29	100	191	Vertical
55.2452	-16.11	29.36	40.00	10.64	100	148	Vertical
152.3423	-14.81	30.71	43.50	12.79	100	332	Vertical
254.2943	-16.92	26.70	46.00	19.30	100	79	Vertical
302.8428	-15.23	27.16	46.00	18.84	100	330	Vertical
826.1962	-6.21	23.63	46.00	22.37	100	30	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

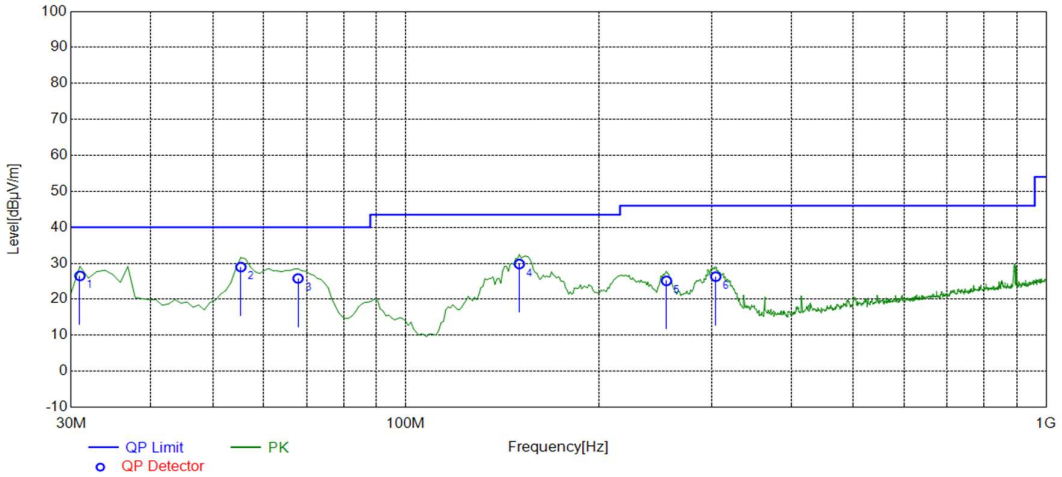
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4882.3017	-14.86	61.82	74.00	12.18	PK	Horizontal	Pass
	4882.3017	-14.86	49.98	54.00	4.02	AV	Horizontal	Pass
	4881.8917	-14.86	59.70	74.00	14.30	PK	Vertical	Pass
	4881.8917	-14.86	46.84	54.00	7.16	AV	Vertical	Pass

8-DPSK Modulation 2480MHz Test Result

30-1000MHz



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
55.2452	-16.11	21.05	40.00	18.95	200	226	Horizontal
84.3744	-20.04	20.51	40.00	19.49	200	240	Horizontal
150.4004	-14.73	25.75	43.50	17.75	200	83	Horizontal
257.2072	-16.81	32.32	46.00	13.68	100	310	Horizontal
303.8138	-15.22	39.57	46.00	6.43	100	21	Horizontal
900.9610	-5.66	27.34	46.00	18.66	200	121	Horizontal



Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
30.9710	-18.36	26.50	40.00	13.50	100	55	Vertical
55.2452	-16.11	28.96	40.00	11.04	100	133	Vertical
67.8679	-18.27	25.80	40.00	14.20	100	243	Vertical
150.4004	-14.73	29.81	43.50	13.69	100	360	Vertical
255.2653	-16.88	25.12	46.00	20.88	100	72	Vertical
304.7848	-15.21	26.30	46.00	19.70	100	160	Vertical

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

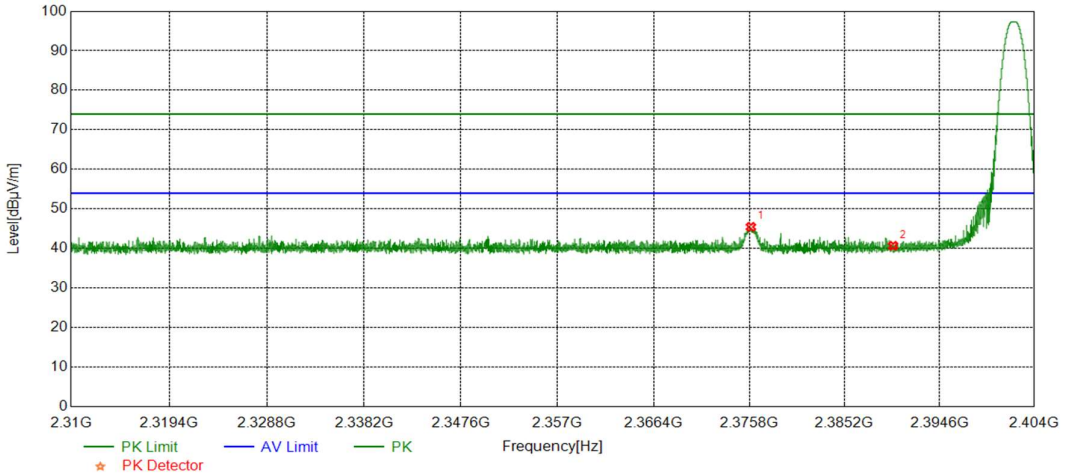
Frequency Band	Freq. [MHz]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Polarization	Result
1000-25000MHz	4960.0192	-14.57	63.98	74.00	10.02	PK	Horizontal	Pass
	4960.0192	-14.57	50.93	54.00	3.07	AV	Horizontal	Pass
	4960.0092	-14.57	61.23	74.00	12.77	PK	Vertical	Pass
	4960.0092	-14.57	48.64	54.00	5.36	AV	Vertical	Pass

Remark:

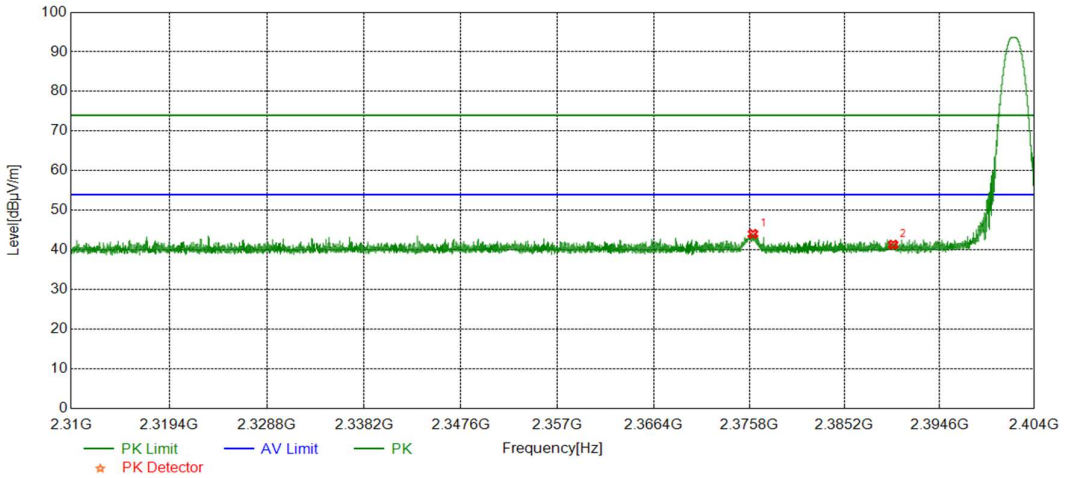
(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss - Amplifier Gain.
(4) Below 1GHz: Corrector factor = Antenna Factor + Cable Loss - Amplifier Gain.
(5) Note: The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Band-edge (Radiated)

GFSK Modulation 2402MHz Test Result



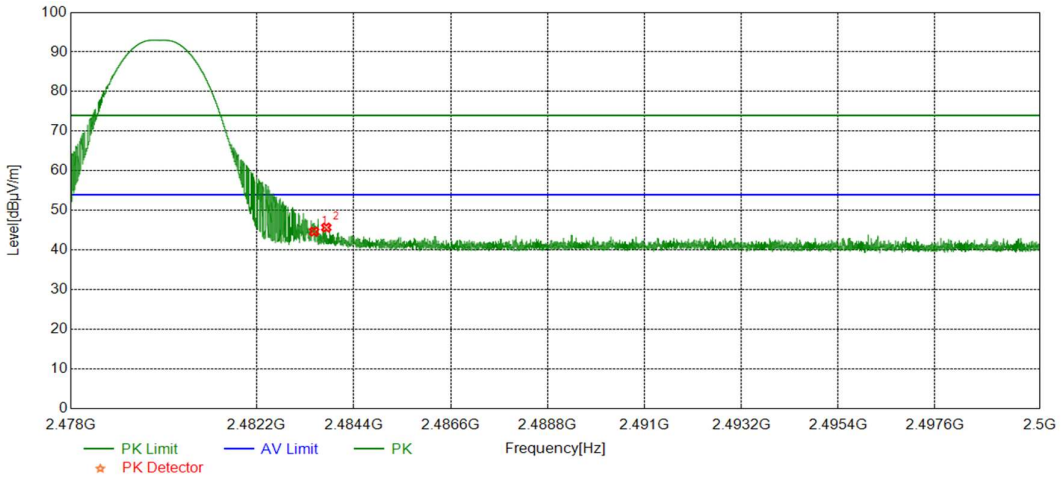
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2375.96	45.46	-22.85	74.00	28.54	178.4	110	Horizontal
2390.00	40.68	-22.81	74.00	33.32	178.4	70	Horizontal



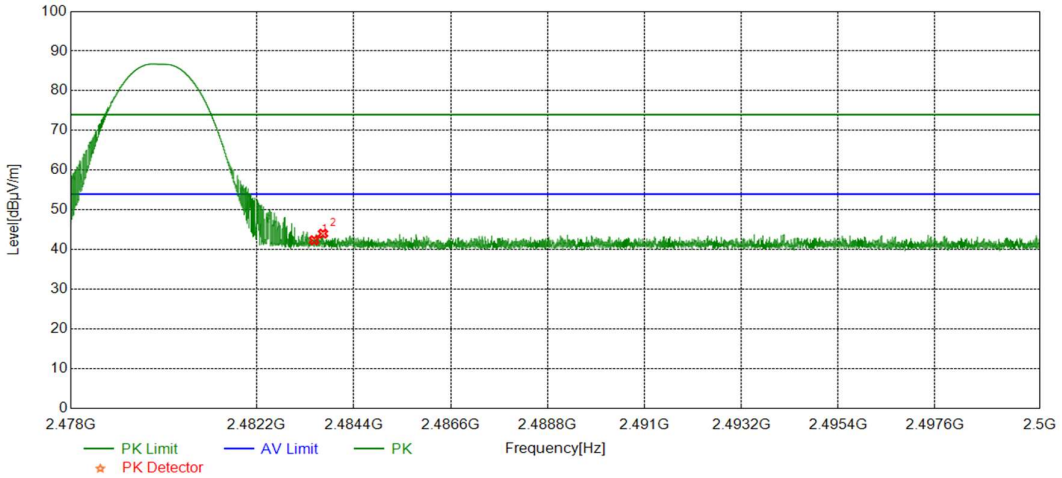
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2376.16	44.07	-22.85	74.00	29.93	107.2	60	Vertical
2390.00	41.35	-22.81	74.00	32.65	107.2	100	Vertical

Level = Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

GFSK Modulation 2480MHz Test Result



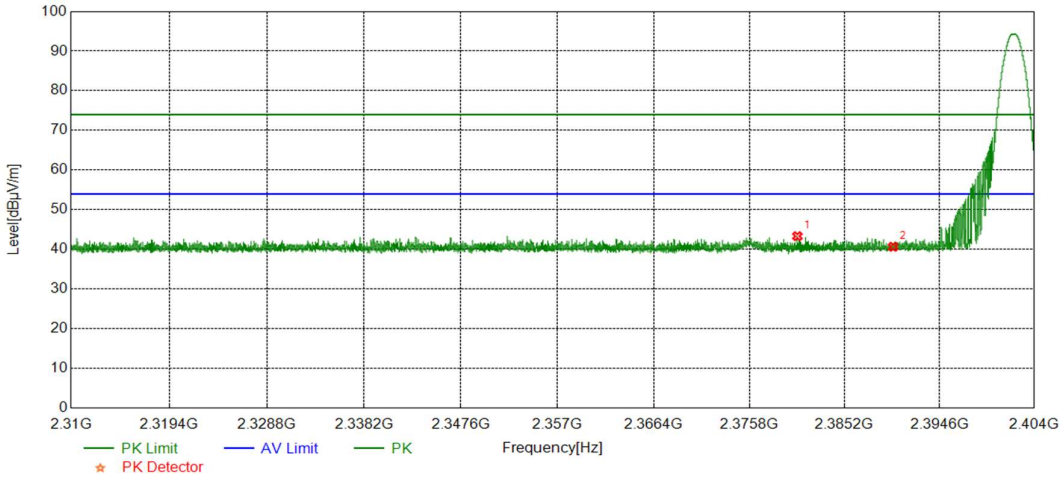
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.50	44.66	-22.52	74.00	29.34	153.4	110	Horizontal
2483.77	45.70	-22.52	74.00	28.30	153.4	60	Horizontal



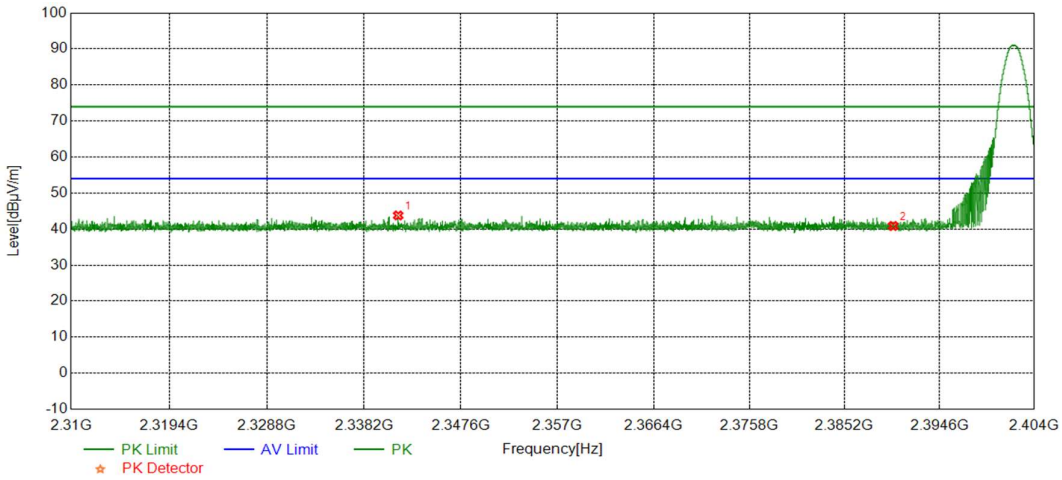
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.50	42.36	-22.52	74.00	31.64	136.3	290	Vertical
2483.70	44.02	-22.52	74.00	29.98	136.3	30	Vertical

Level = Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

π /4-DQPSK Modulation 2402MHz Test Result



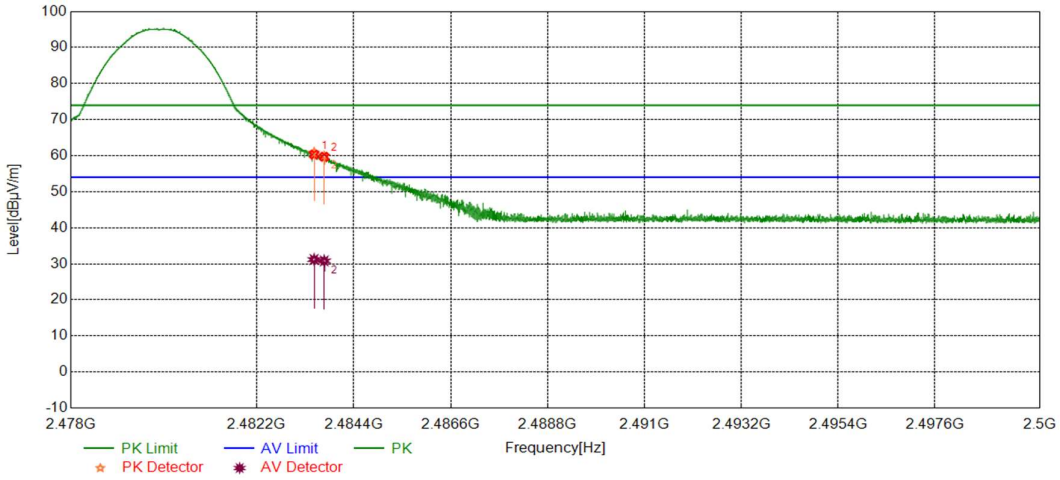
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2380.54	43.34	-22.84	74.00	30.66	138.4	140	Horizontal
2390.00	40.66	-22.81	74.00	33.34	138.4	40	Horizontal



Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2341.51	43.79	-22.95	74.00	30.21	162.3	210	Vertical
2390.00	40.87	-22.81	74.00	33.13	162.3	180	Vertical

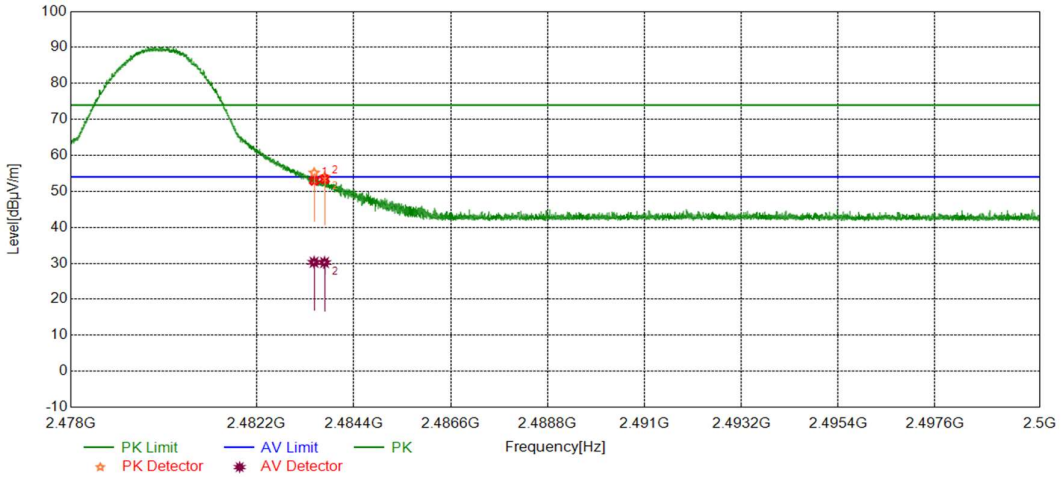
Level = Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

π /4-DQPSK Modulation 2480MHz Test Result



Freq. [MHz]	Factor [dB/m]	PK Value [dBμV/m]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.5000	-22.52	60.84	74.00	13.16	153.4	90	Horizontal
2483.7291	-22.52	59.85	74.00	14.15	153.4	90	Horizontal

Freq. [MHz]	Factor [dB/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.5000	-22.52	31.19	54.00	22.81	153.4	90	Horizontal
2483.7291	-22.52	30.80	54.00	23.20	153.4	90	Horizontal

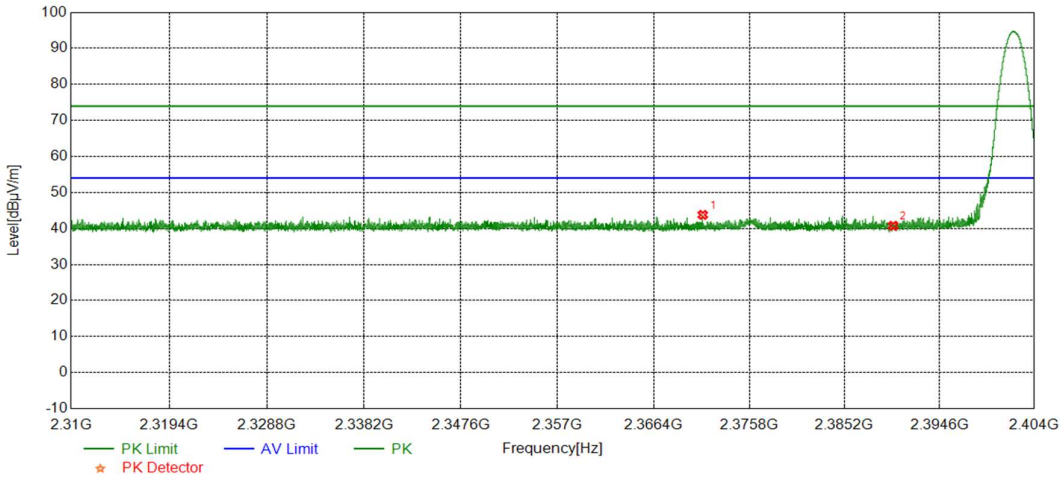


Freq. [MHz]	Factor [dB/m]	PK Value [dBµV/m]	PK Limit [dBµV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.5000	-22.52	55.16	74.00	18.84	136.3	50	Vertical
2483.7368	-22.52	54.00	74.00	20.00	136.3	50	Vertical

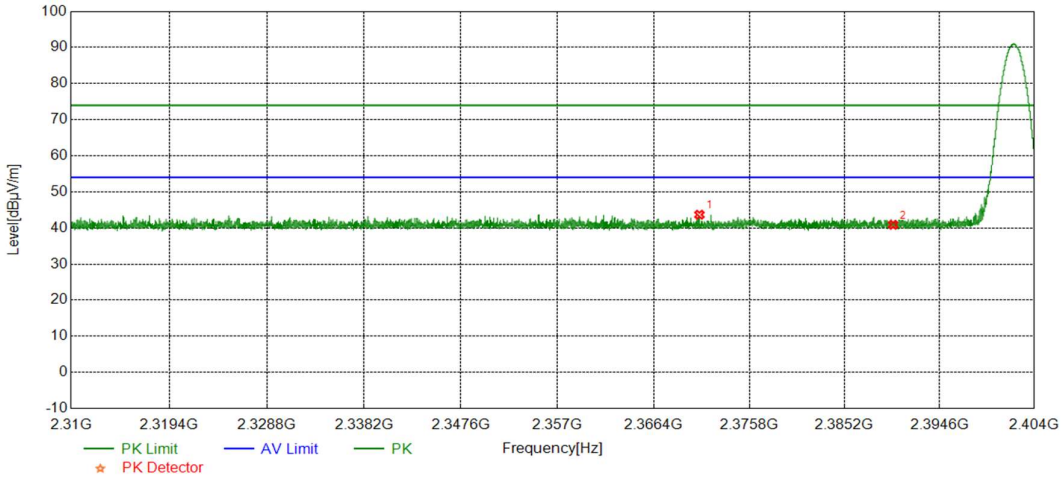
Freq. [MHz]	Factor [dB/m]	AV Value [dBµV/m]	AV Limit [dBµV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.5000	-22.52	30.28	54.00	23.72	136.3	50	Vertical
2483.7368	-22.52	30.22	54.00	23.78	136.3	50	Vertical

Level = Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

8-DPSK Modulation 2402MHz Test Result



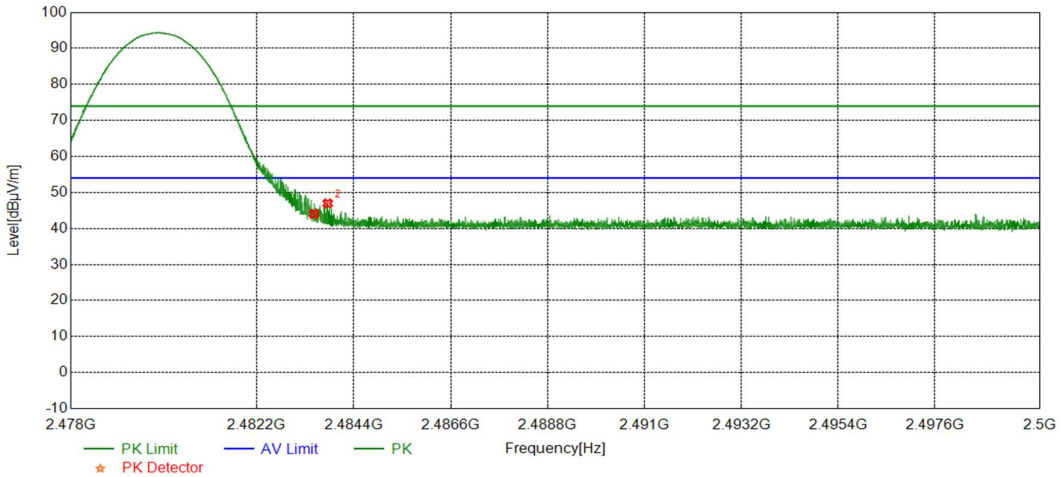
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2371.23	43.79	-22.86	74.00	30.21	138.4	190	Horizontal
2390.00	40.76	-22.81	74.00	33.24	138.4	10	Horizontal



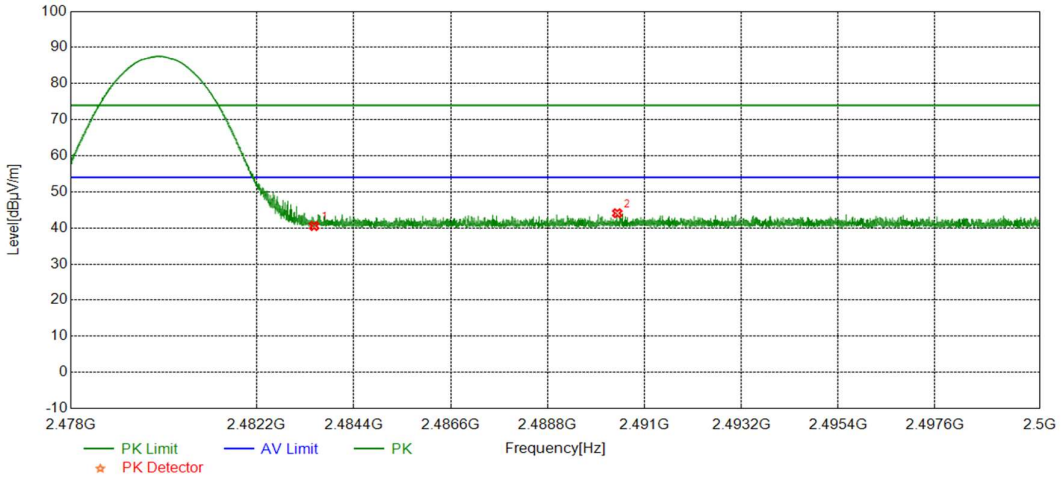
Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2370.90	43.68	-22.87	74.00	30.32	162.3	100	Vertical
2390.00	40.88	-22.81	74.00	33.12	162.3	20	Vertical

Level = Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

8-DPSK Modulation 2480MHz Test Result



Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.50	44.06	-22.52	74.00	29.94	153.4	140	Horizontal
2483.80	46.98	-22.52	74.00	27.02	153.4	200	Horizontal



Freq. [MHz]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
2483.50	40.53	-22.52	74.00	33.47	136.3	220	Vertical
2490.37	44.09	-22.50	74.00	29.91	136.3	250	Vertical

Level= Read level + Factor
Factor= Antenna Factor + Cable loss – Preamp Factor

3.11 Hopping sequence requirement

Limit:

FCC §15.207 (g)

FCC §15.207 (h)

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Result: Meet the requirements of this chapter

End