



RF TEST REPORT

Applicant Huawei Technologies Co., Ltd.
FCC ID QISBAH2-W19
Product Tablet
Model BAH2-W19
Report No. R1806H0070-R2V1
Issue Date July 17, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of Measurement Results

Number	Summary of measurements of results	Clause in FCC rules	Verdict
1	Peak Power Output -Conducted	15.247(b)(1)	PASS
2	Occupied Bandwidth (20dB)	15.247(a)(1)	PASS
3	Frequency Separation	15.247(a)(1)	PASS
4	Time of Occupancy (Dwell Time)	15.247(a)(1)(iii)	PASS
5	Band Edge Compliance	15.247(d)	PASS
6	Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
7	Spurious RF Conducted Emissions	15.247(d)	PASS
8	Unwanted Emissions	15.247(d),15.205,15.209	PASS
9	AC Power Line Conducted Emission	15.207	PASS
10	Frequency Hopping System	15.247 (g), (h)	PASS
Date of Testing: June 27, 2018~ July 3, 2018			

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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City: Shanghai
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2 General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.

General information

EUT Description			
Model	BAH2-W19		
SN:	18052675749		
Hardware Version	SH0BAH2LM		
Software Version	BAH2-W19 8.0.0.10(C605)		
Power Supply	Battery/AC adapter		
Antenna Type	Internal Antenna		
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)		
Antenna Gain	0 dBi		
Test Mode(s)	Basic Rate	Enhanced Data Rate(EDR)	
Modulation Type	Frequency Hopping Spread Spectrum (FHSS)		
	GFSK	$\pi/4$ DQPSK	8DPSK
Packet Type (Maximum Payload)	DH5	2DH5	3DH5
Max. Conducted Power	9.85dBm		
Operating Frequency Range(s)	2402-2480 MHz		
EUT Accessory			
Adapter 1	Brand: HUAWEI Manufacturer: Salcomp (Shenzhen) Co., Ltd. Model: HW-059200UHQ		
Adapter 2	Brand: HUAWEI Manufacturer: HUIZHOU BYD ELECTRONIC CO.,LTD. Model: HW-059200UHQ		
Adapter 3	Brand: HUAWEI Manufacturer: Salcomp (Shenzhen) Co., Ltd. Model: HW-090200UH0		
Adapter 4	Brand: HUAWEI		



	Manufacturer: Shenzhen Kuntkey Electric Co., Ltd. Model: HW-090200UH0
Battery 1	Brand: HUAWEI Manufacturer: SCUD (Fujian) Electronics Co., Ltd. Model: HB2994I8ECW
Battery 2	Brand: HUAWEI Manufacturer: SUNWODA Electronic Co., Ltd Model: HB2994I8ECW
Battery 3	Brand: HUAWEI Manufacturer: Huizhou Desay Battery Co., Ltd Model: HB2994I8ECW
USB Cable 1	USB data cable,white,1m
USB Cable 2	USB-A to USB-C Charge Data Cable,1.0m
Note: 1. The information of the EUT is declared by the manufacturer. 2. There is more than one USB cable, one Adapter and one Battery, each one should be applied throughout the compliance test respectively, and however, only the worst case (USB cable 1/ Adapter 1/ Battery 1) will be recorded in this report.	

BAH2-W19 has two storage scenarios, with different memory. EMCP Storage Capacity is 3GB+32GB, LPDDR3+EMMC separation Scheme storage capacity is 4GB+64GB. The two storage mode of peripheral circuit has slight change, but does not affect product performance.

The differences about storage scenarios are showed in the following table. Other parts of the Tablet are the same, including the appearance, the antenna, Chipset, Bluetooth mode, Wifi mode, Adapter, Battery, Mainboard, Software and so on.

Model	BAH2-W19	
Storage Scenarios	EMCP	LPDDR3+eMMC
Storage capacity	3GB+32GB	4GB+64GB



3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards

- **FCC CFR47 Part 15C (2018) Radio Frequency Devices**
- **ANSI C63.10 (2013)**
- **DA00-705 Filing and Frequency Measurement Guidelines For Frequency Hopping Spread Spectrum System (2000).**

4 Information about the FHSS characteristics

4.1 Frequency Hopping System Requirement

Standard requirement:

(g) 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.

(h) 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.

Compliance for section 15.247(g):

According to Bluetooth Core Specification, the Bluetooth system transmits the packets with the pseudorandom hopping frequency with a continuous data and short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Bluetooth Core Specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to Bluetooth Core Specification, the Bluetooth system is designed not have the ability to coordinate with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

4.2 Pseudorandom Frequency Hopping Sequence

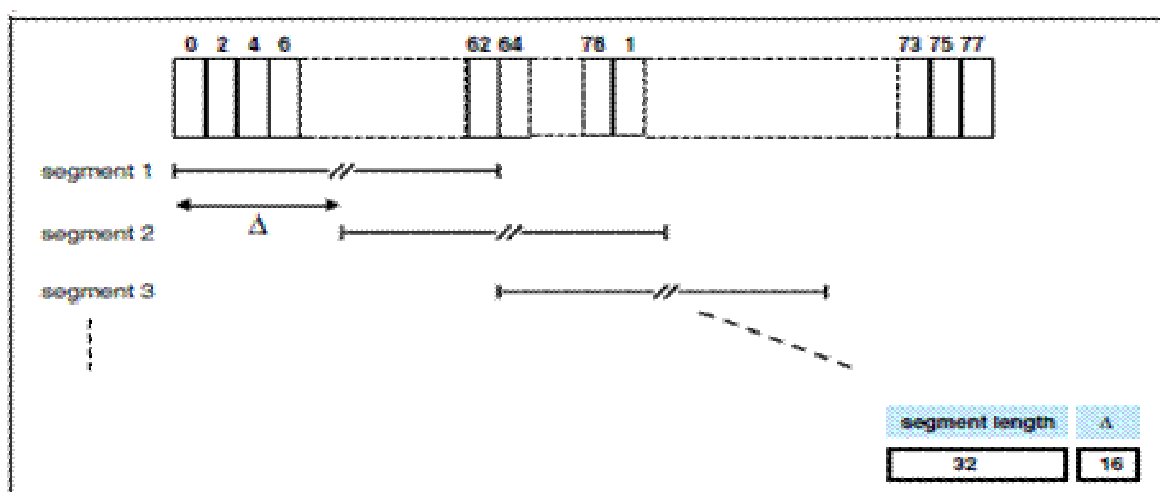
Frequency Hopping Systems. A spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The wide RF bandwidth needed by such a system is not required by spreading of the RF energy about the carrier but rather to accommodate the range of frequencies to which the carrier frequency can hop. The test of a frequency hopping system is that the near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an

effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its pioneer to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

The selection scheme chooses a segment of 32 hop frequencies spanning about 64 MHz and visits these hops in a pseudo-random order. Next, a different 32-hop segment is chosen, etc. In the page, master page response, slave page response, page scan, inquiry, inquiry response and inquiry scan hopping sequences, the same 32-hop segment is used all the time (the segment is selected by the address; different devices will have different paging segments).

When the basic channel hopping sequence is selected, the output constitutes a pseudo-random sequence that slides through the 79 hops. The principle is depicted in the figure below.



Hop selection scheme in CONNECTION state.

Pseudorandom Frequency Hopping Sequence Table as below:

Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45, etc.

Each frequency used equally on the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

4.3 Equal Hopping Frequency Use

All Bluetooth units participating in the Pico net are time and hop-synchronized to the channel. Each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event.

4.4 System Receiver Input Bandwidth

Each channel bandwidth is 1MHz. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

4.5 Test Configuration

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

Test Cases	Test Modes
Peak Power Output -Conducted	DH5/2DH5/3DH5
Occupied Bandwidth (20dB)	DH5/2DH5/3DH5
Frequency Separation	DH5/2DH5/3DH5
Time of Occupancy (Dwell Time)	DH5/2DH5/3DH5
Band Edge Compliance	DH5/2DH5/3DH5
Number of Hopping Frequency	DH5/2DH5/3DH5
Spurious RF Conducted Emissions	DH5/2DH5/3DH5
Unwanted Emission	DH5/3DH5
Conducted Emission	DH5/3DH5

5 Test Case Results

5.1 Peak Power Output –Conducted

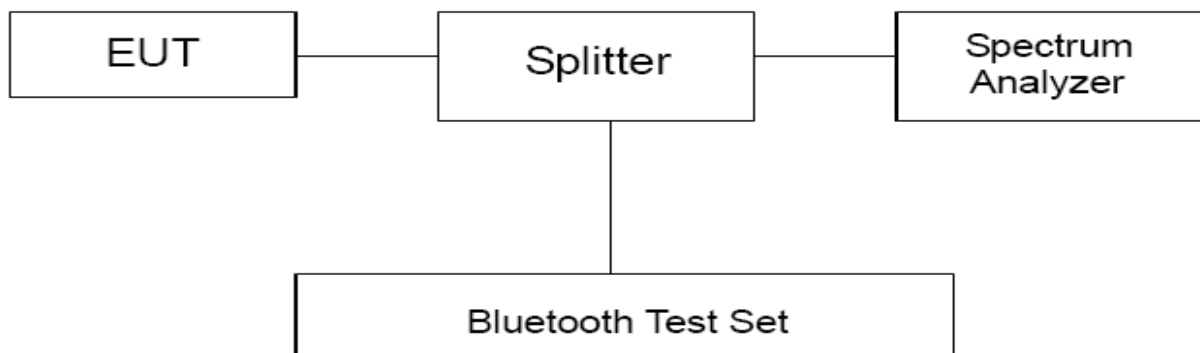
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The EUT is controlled by the Bluetooth test set to ensure max power transmission with proper modulation. The peak detector is used. RBW is set to 2 MHz; VBW is set to 6 MHz. These measurements have been tested at following channels: 0, 39, and 78.

Test Setup



Limits

Rule Part 15.247 (b) (1) specifies that " For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts."

Peak Output Power	$\leq 0.125\text{W}$ (21dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=0.44$ dB.

Test Results

Channel	Frequency (MHz)	Peak Output Power (dBm)			Conclusion
		DH5	2DH5	3DH5	
0	2402	9.63	9.85	9.81	PASS
39	2441	9.01	9.49	9.74	PASS
78	2480	8.88	9.27	9.52	PASS

Note: The measured power density (dBm) has the offset with cable loss already.

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.1dBm.

5.2 Occupied Bandwidth (20dB)

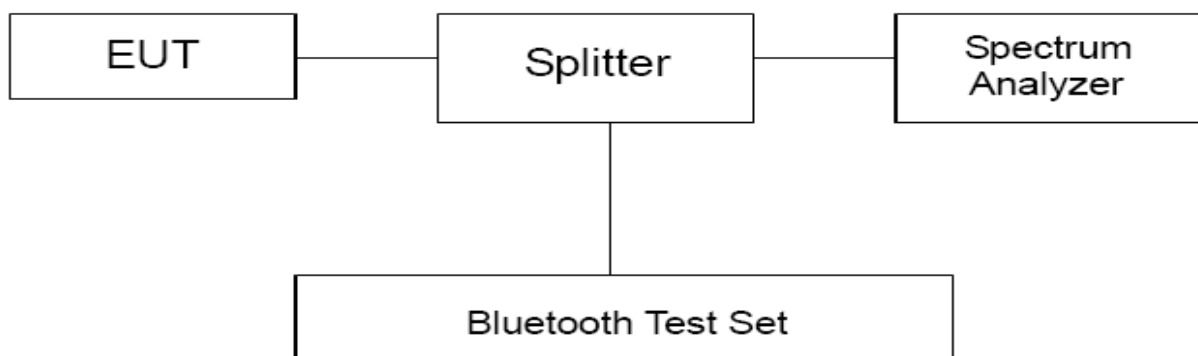
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The occupied bandwidth is measured using spectrum analyzer. RBW is set to 30kHz and VBW is set to 100kHz on spectrum analyzer. -20dB occupied bandwidths are recorded.

Test Setup



Limits

No specific occupied bandwidth requirements in part 15.247(a) (1).

Measurement Uncertainty

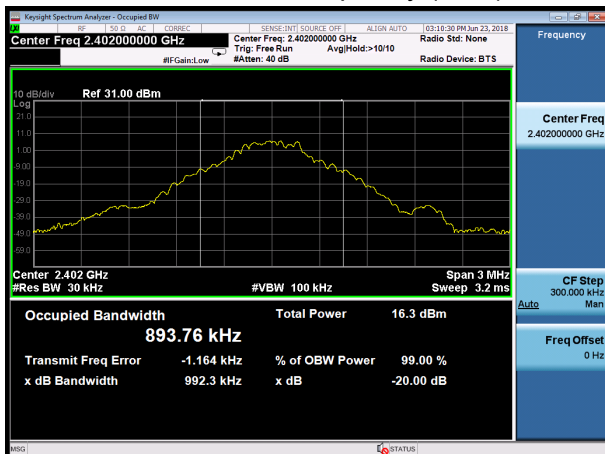
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

Test Results

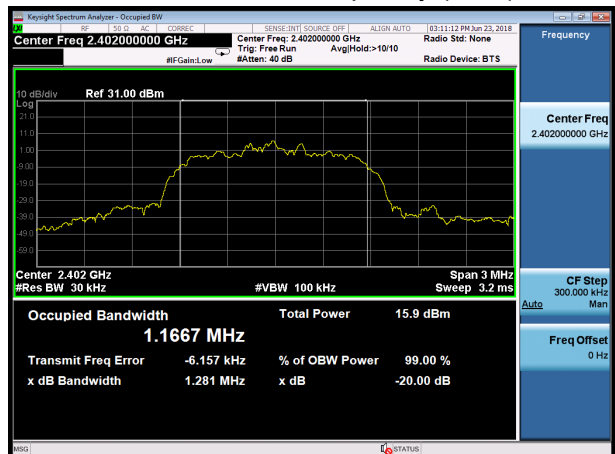
Mode		Channel	Frequency (MHz)	99% bandwidth(kHz)	20dB Bandwidth(kHz)
BT	DH5	0	2402	893.76	992.3
		39	2441	890.85	975.3
		78	2480	888.12	986.5
	2DH5	0	2402	1166.7	1281.0
		39	2441	1166.2	1281.0
		78	2480	1165.8	1282.0
	3DH5	0	2402	1167.2	1290.0
		39	2441	1163.7	1286.0
		78	2480	1166.9	1288.0



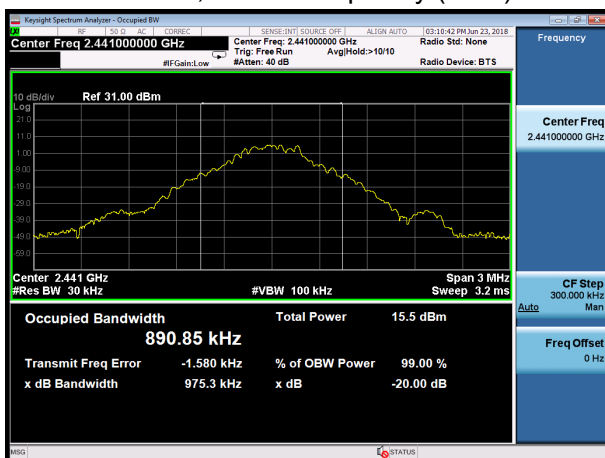
BT DH5 CH0, Carrier frequency (MHz): 2402



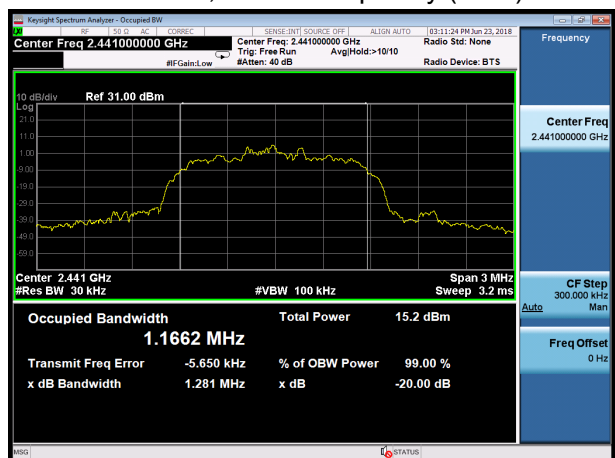
BT 2DH5 CH0, Carrier frequency (MHz): 2402



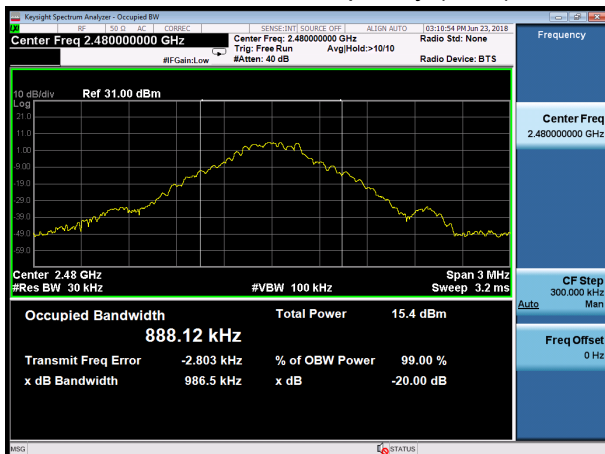
BT DH5 CH39, Carrier frequency (MHz): 2441



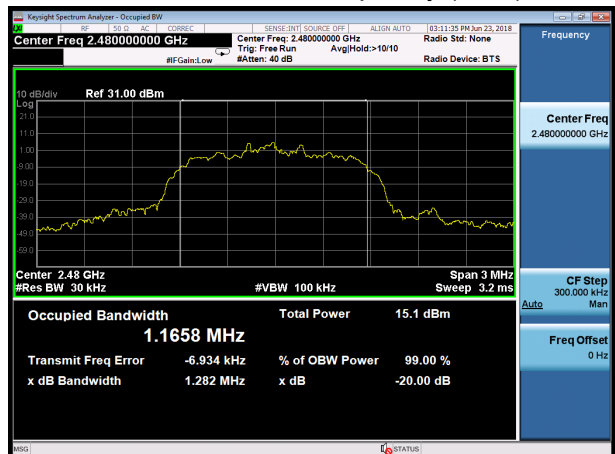
BT 2DH5 CH39, Carrier frequency (MHz): 2441



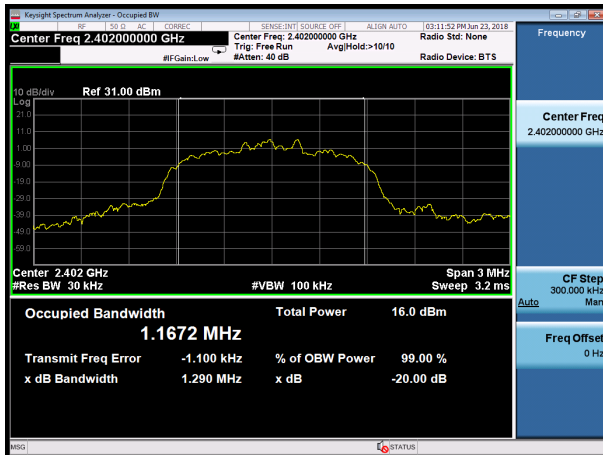
BT DH5 CH78, Carrier frequency (MHz): 2480



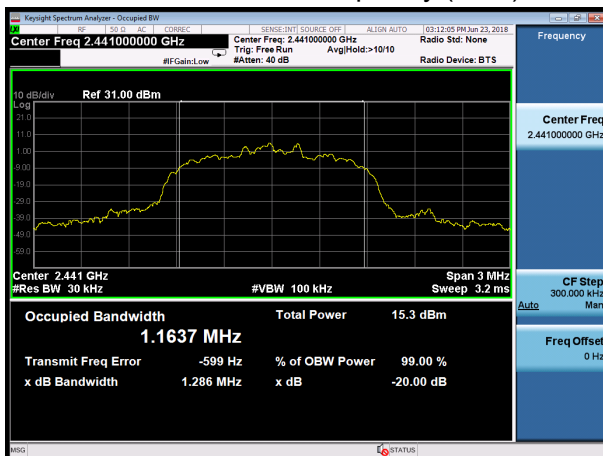
BT 2DH5 CH78, Carrier frequency (MHz): 2480



BT 3DH5 CH0, Carrier frequency (MHz): 2402



BT 3DH5 CH39, Carrier frequency (MHz): 2441



BT 3DH5 CH78, Carrier frequency (MHz): 2480



5.3 Frequency Separation

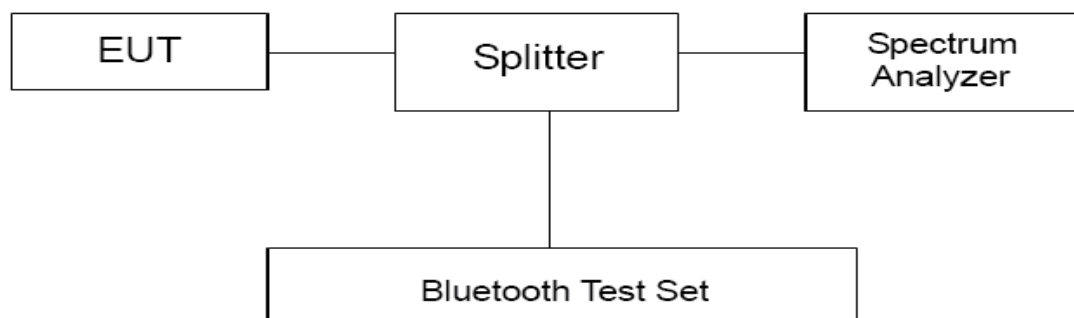
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 30 kHz and VBW is set to 100 kHz on spectrum analyzer. Set EUT on Hopping on mode.

Test setup



Limits

Rule Part 15.247(a)(1) specifies that “Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping 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. ”

Note: The value of two-thirds of 20 dB bandwidth is always greater than 25 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

Test Results:

Packet type	Carrier frequency (MHz)	Carrier frequency separation(kHz)	20dB Bandwidth(kHz)	Limit (kHz)	Conclusion
DH5	2402	999	992.3	661.53	PASS
	2441	999	975.3	650.20	PASS
	2480	999	986.5	657.67	PASS
2DH5	2402	999	1281.0	854.00	PASS
	2441	999	1281.0	854.00	PASS
	2480	999	1282.0	854.67	PASS
3DH5	2402	999	1290.0	860.00	PASS
	2441	999	1286.0	857.33	PASS
	2480	999	1288.0	858.67	PASS
Note: The limit is two-thirds of 20 dB bandwidth.					



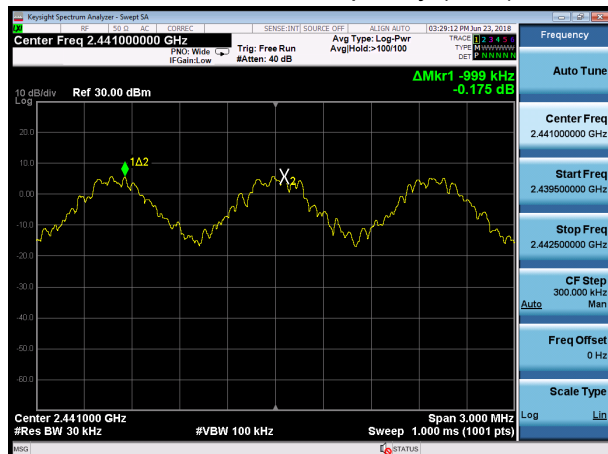
BT DH5 CH0, Carrier frequency (MHz): 2402



BT 2DH5 CH0, Carrier frequency (MHz): 2402



BT DH5 CH39, Carrier frequency (MHz): 2441



BT 2DH5 CH39, Carrier frequency (MHz): 2441



BT DH5 CH78, Carrier frequency (MHz): 2480



BT 2DH5 CH78, Carrier frequency (MHz): 2480





BT 3DH5 CH0, Carrier frequency (MHz): 2402



BT 3DH5 CH39, Carrier frequency (MHz): 2441



BT 3DH5 CH78, Carrier frequency (MHz): 2480



5.4 Time of Occupancy (Dwell Time)

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

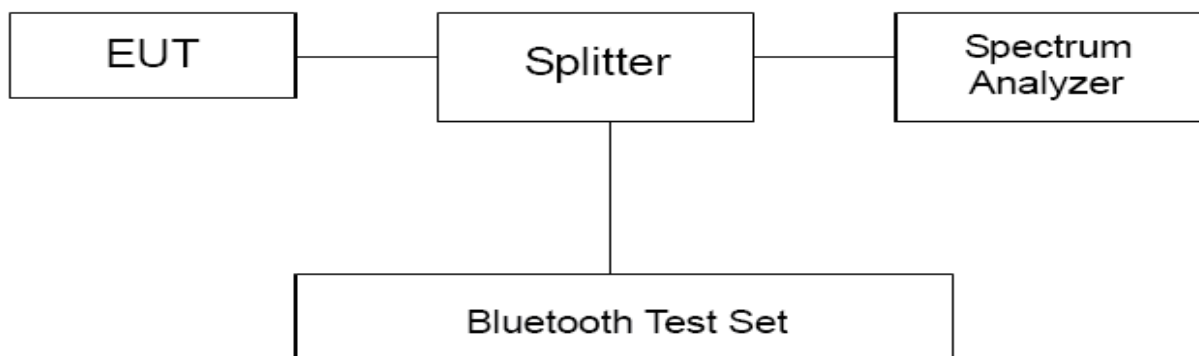
The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 1MHz and VBW is set to 1MHz on spectrum analyzer. The dwell time is calculated by:

Dwell time = time slot length * hop rate * 0.4s with:

In normal mode, The selected EUT Packet type uses a slot type of DH5 packet and a hopping rate of 1600(ch*hop/s) for all channels. So the final hopping rate for all channel is $1600/5=320$ (ch*hop/s)

In AFH mode, The selected EUT Packet type uses a slot type of DH5 packet and a hopping rate of 800(ch*hop/s) for all channels. So the final hopping rate for all channel is $800/5=320$ (ch*hop/s)

Test Setup



Limits

Rule Part15.247(a) specifies that " Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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."

Dwell time	$\leq 400\text{ms}$
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$.

Requirements	Uncertainty					
Dwell Time	DH5	$U=0.70\text{ms}$	2DH5	$U=0.70\text{ms}$	3DH5	$U=0.70\text{ms}$

Test Results:

In normal mode:

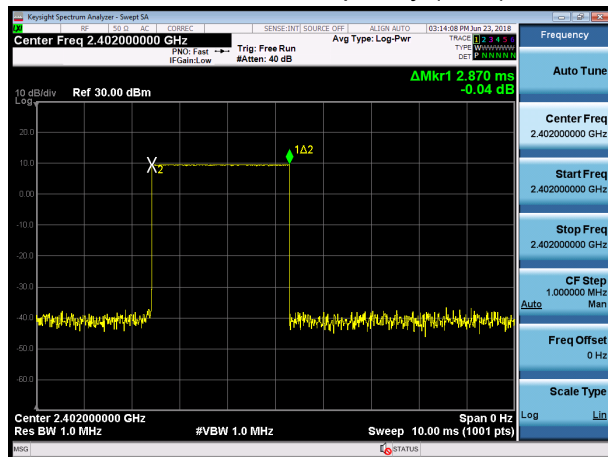
Packet type	Channel	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
DH5	0	320	2.870	367.36	400	PASS
	39	320	2.870	367.36	400	PASS
	78	320	2.870	367.36	400	PASS
2DH5	0	320	2.880	368.64	400	PASS
	39	320	2.880	368.64	400	PASS
	78	320	2.880	368.64	400	PASS
3DH5	0	320	2.880	368.64	400	PASS
	39	320	2.880	368.64	400	PASS
	78	320	2.880	368.64	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						

In AFH mode:

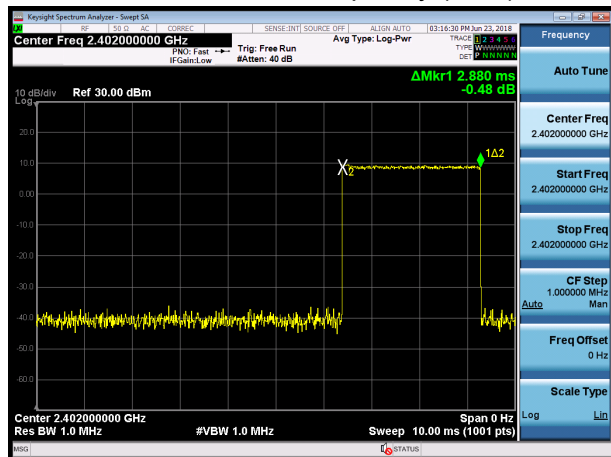
Packet type	Channel	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
DH5	0	160	2.870	183.680	400	PASS
	39	160	2.870	183.680	400	PASS
	78	160	2.870	183.680	400	PASS
2DH5	0	160	2.880	184.320	400	PASS
	39	160	2.880	184.320	400	PASS
	78	160	2.880	184.320	400	PASS
3DH5	0	160	2.880	184.320	400	PASS
	39	160	2.880	184.320	400	PASS
	78	160	2.880	184.320	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						



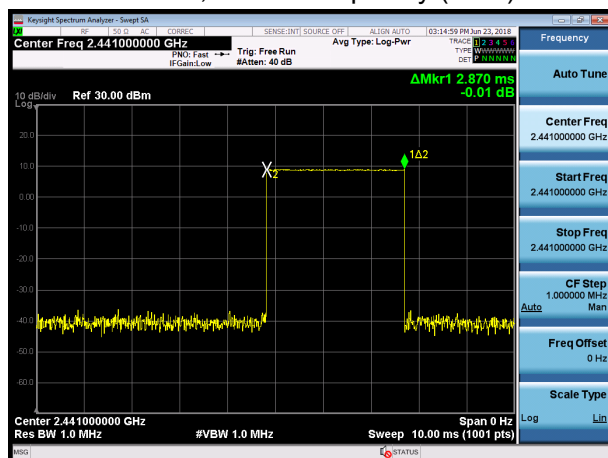
BT DH5 CH0, Carrier frequency (MHz): 2402



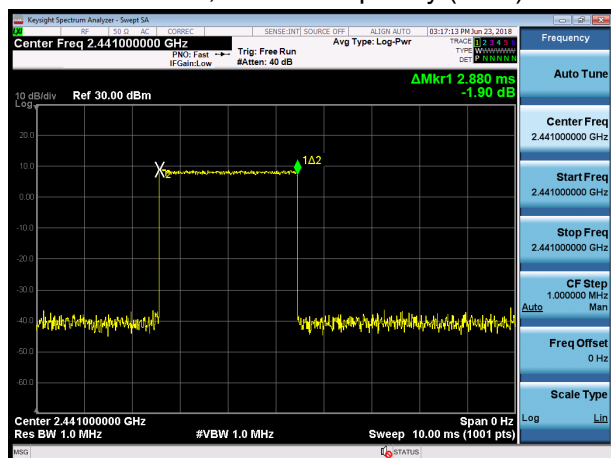
BT 2DH5 CH0, Carrier frequency (MHz): 2402



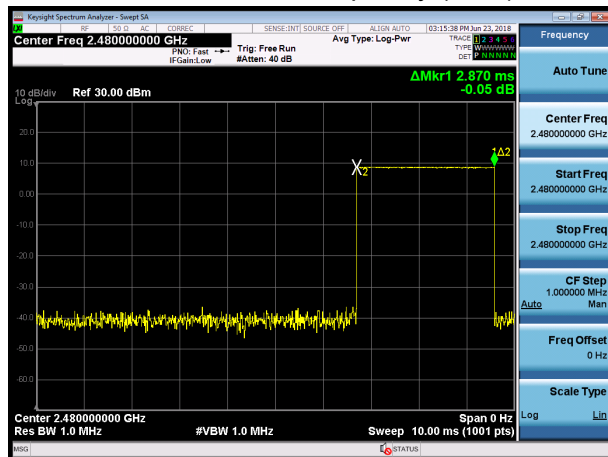
BT DH5 CH39, Carrier frequency (MHz): 2441



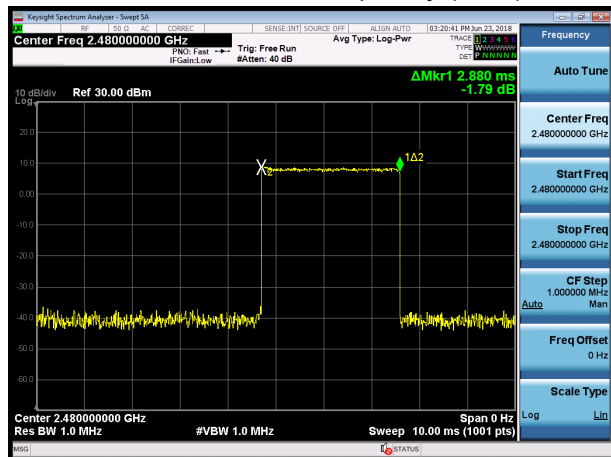
BT 2DH5 CH39, Carrier frequency (MHz): 2441



BT DH5 CH78, Carrier frequency (MHz): 2480

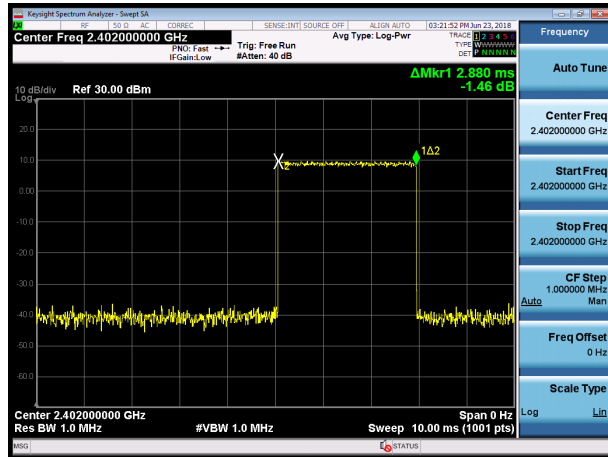


BT 2DH5 CH78, Carrier frequency (MHz): 2480

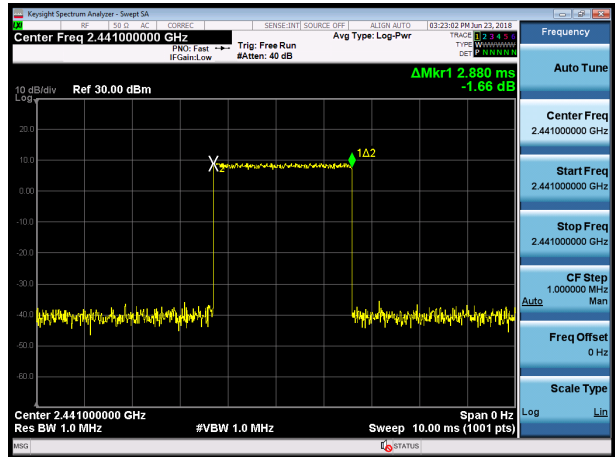




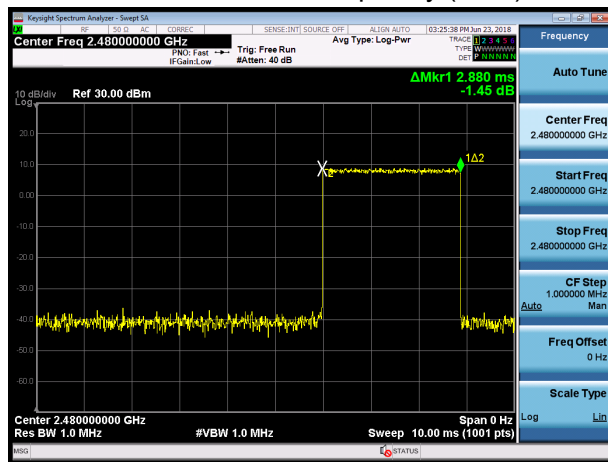
BT 3DH5 CH0, Carrier frequency (MHz): 2402



BT 3DH5 CH39, Carrier frequency (MHz): 2441



BT 3DH5 CH78, Carrier frequency (MHz): 2480



5.5 Band Edge Compliance

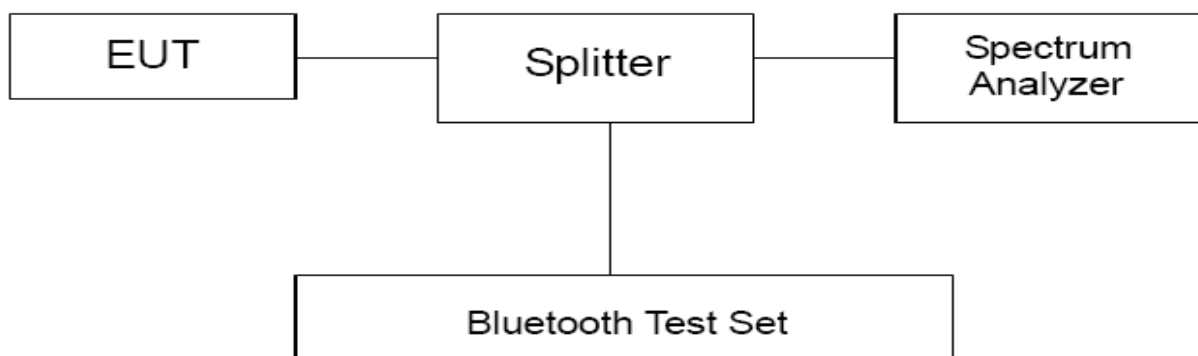
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The lowest and highest channels were measured. The peak detector is used. RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. EUT test for Hopping On mode and Hopping Off mode.

Test Setup



Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.”

Measurement Uncertainty

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

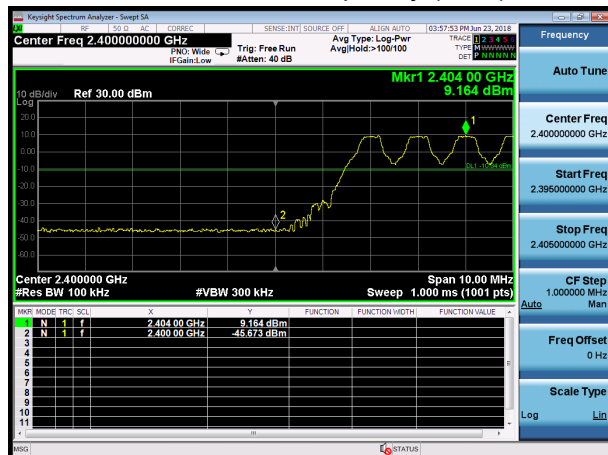
Frequency	Uncertainty
2GHz-3GHz	1.407 dB



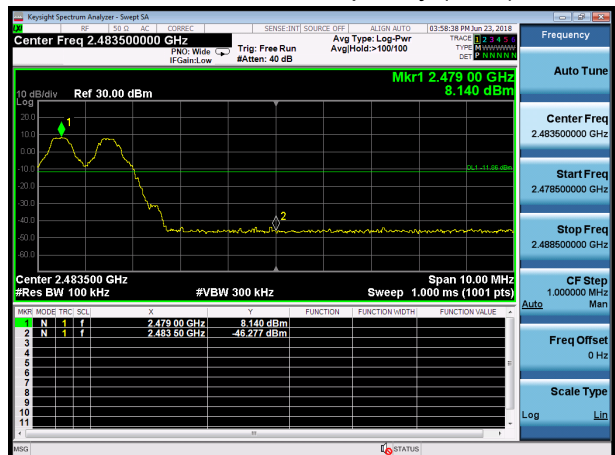
Test Results

Hopping On

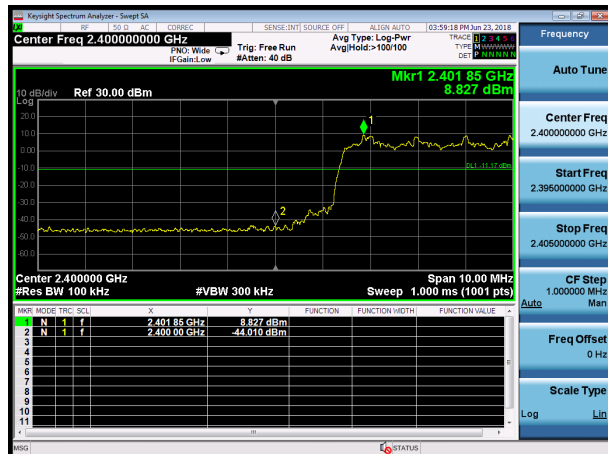
BT DH5 CH0, Carrier frequency (MHz): 2402



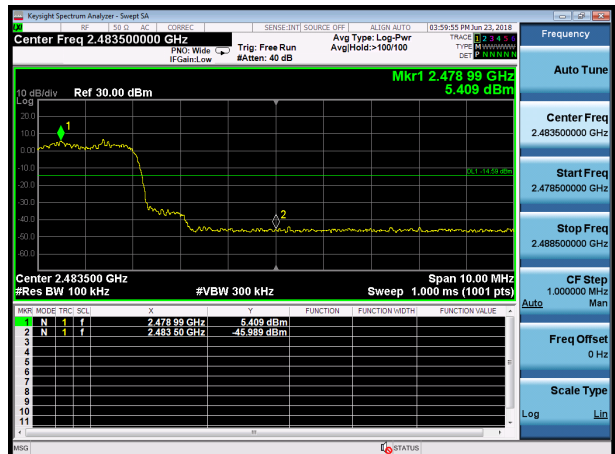
BT DH5 CH78, Carrier frequency (MHz): 2480



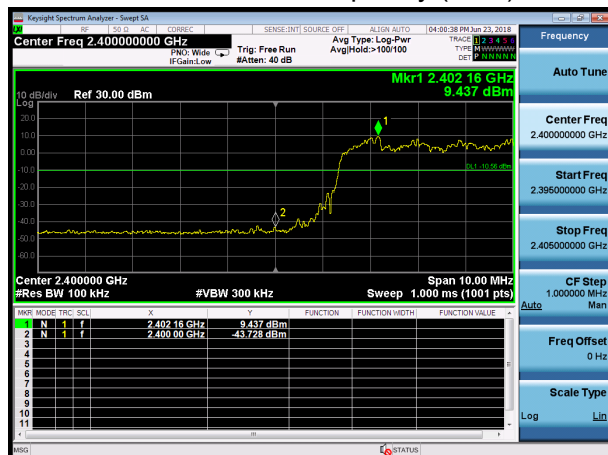
BT 2DH5 CH0, Carrier frequency (MHz): 2402



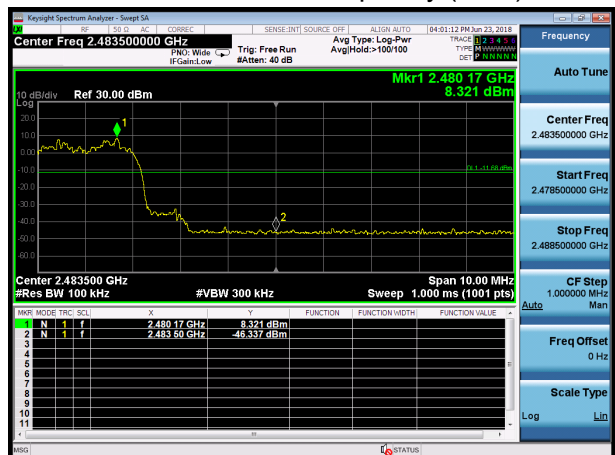
BT 2DH5 CH78, Carrier frequency (MHz): 2480



BT 3DH5 CH0, Carrier frequency (MHz): 2402



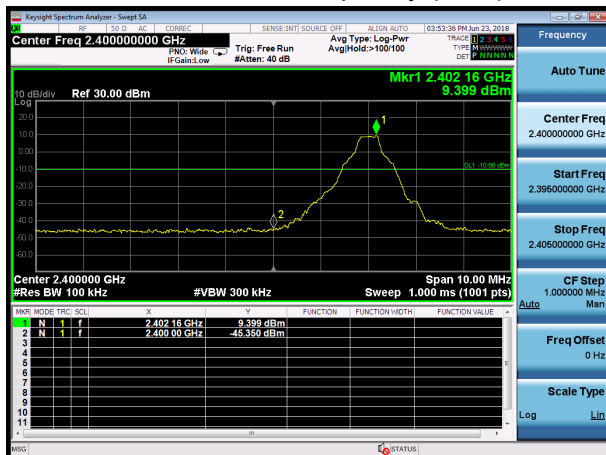
BT 3DH5 CH78, Carrier frequency (MHz): 2480



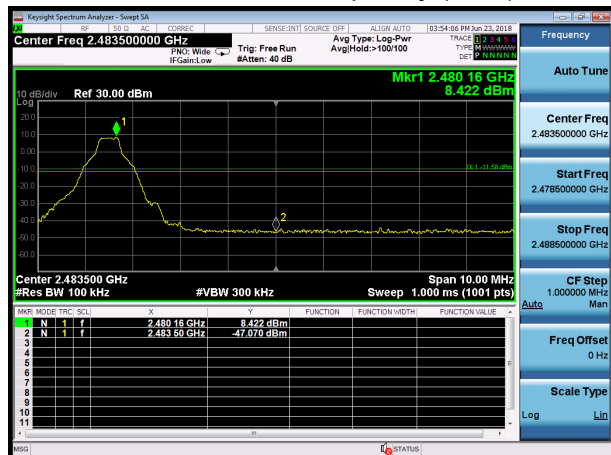


Hopping Off

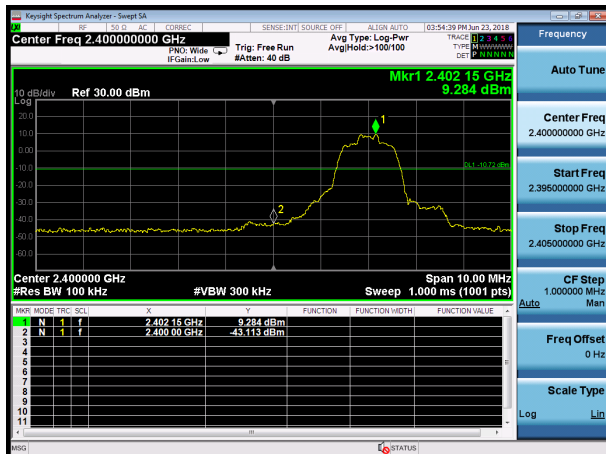
BT DH5 CH0, Carrier frequency (MHz): 2402



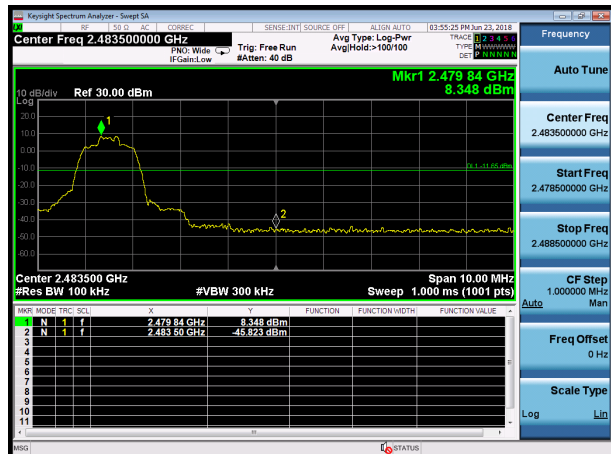
BT DH5 CH78, Carrier frequency (MHz): 2480



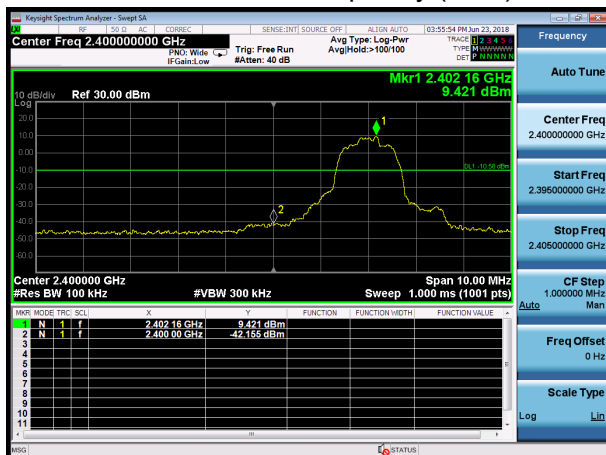
BT 2DH5 CH0, Carrier frequency (MHz): 2402



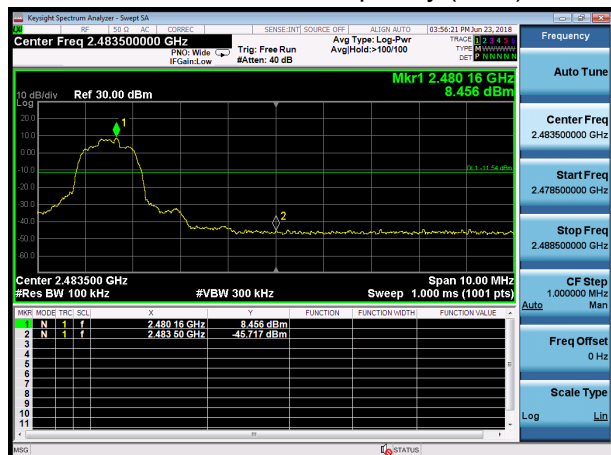
BT 2DH5 CH78, Carrier frequency (MHz): 2480



BT 3DH5 CH0, Carrier frequency (MHz): 2402



BT 3DH5 CH78, Carrier frequency (MHz): 2480



5.6 Number of hopping Frequency

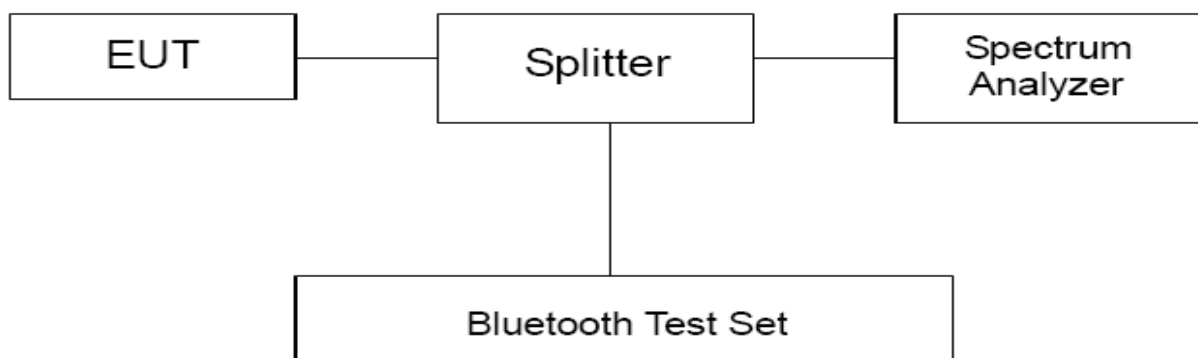
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. RBW is set to 100KHz and VBW is set to 300KHz on spectrum analyzer. Set EUT on Hopping on mode.

Test setup



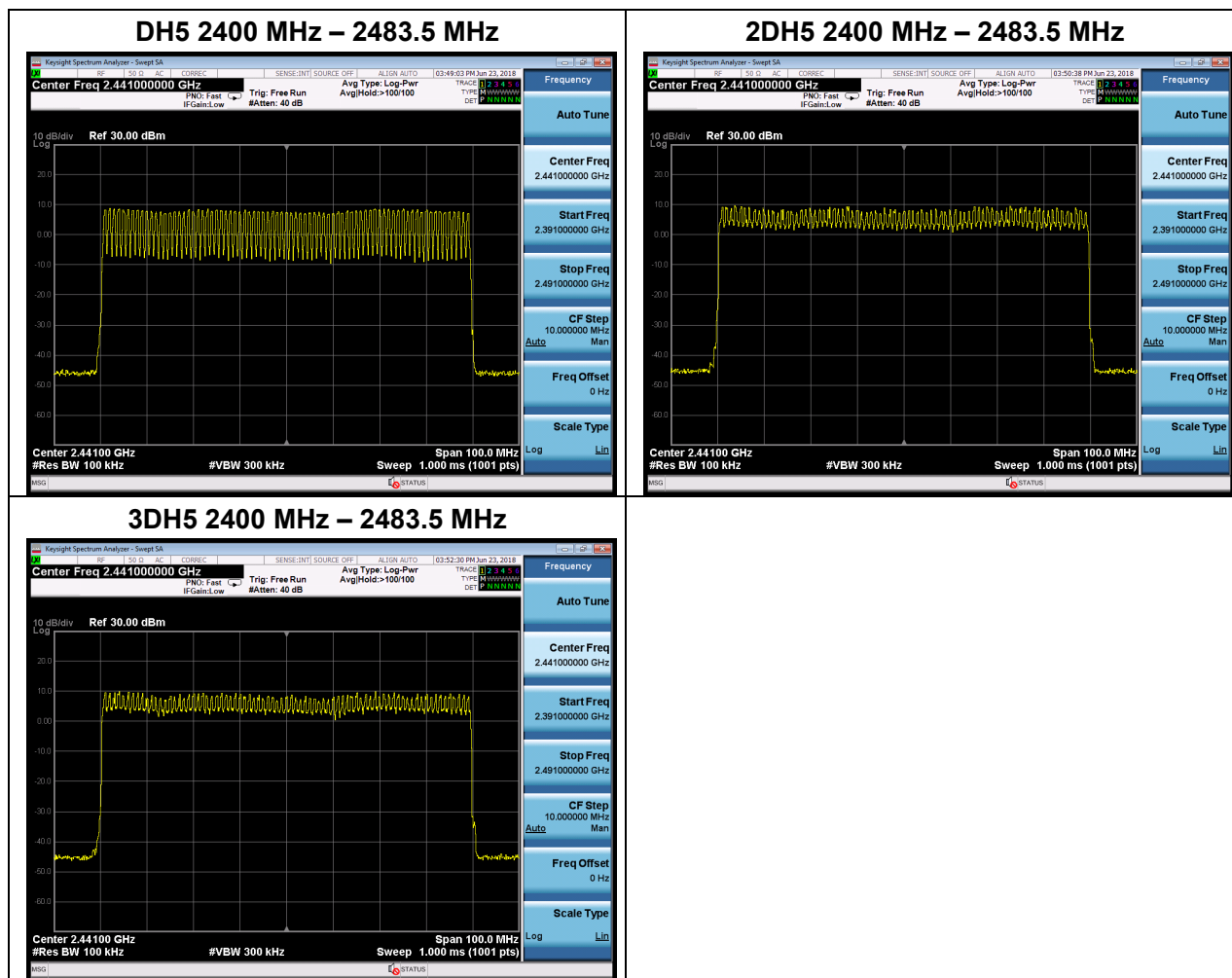
Limits

Rule Part 15.247(a) (1) (iii) specifies that" Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels."

Limits	≥ 15 channels
--------	---------------

Test Results:

Mode		Number of hopping channels	conclusion
BT	DH5	79	PASS
	2DH5	79	PASS
	3DH5	79	PASS



5.7 Spurious RF Conducted Emissions

Ambient condition

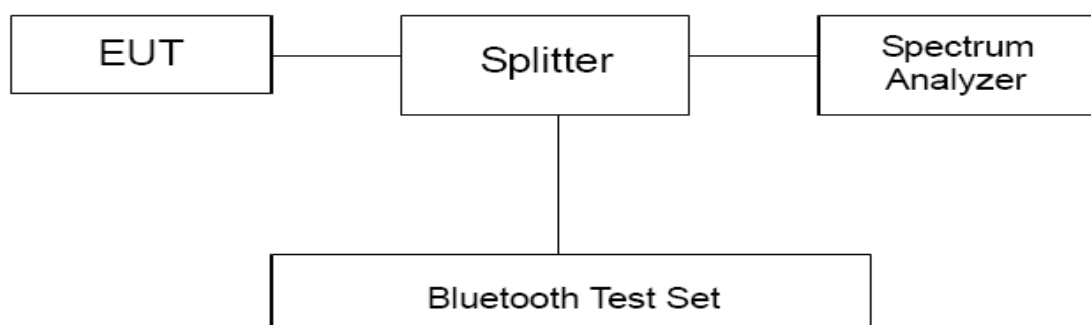
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW 100kHz and VBW 300 kHz, Sweep is set to ATUO.

The test is in transmitting mode.

Test setup



Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.”

Mode	Carrier frequency (MHz)	Reference value (dBm)	Limit
DH5	2402	8.87	-11.13
	2441	8.24	-11.76
	2480	8.48	-11.52
2DH5	2402	8.81	-11.19
	2441	8.54	-11.46
	2480	7.41	-12.59
3DH5	2402	8.00	-12.00
	2441	8.59	-11.41
	2480	6.89	-13.11

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
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

The signal beyond the limit is carrier.

Keysight Spectrum Analyzer - Single SA

Start Freq 30.000000 MHz

Ref 30.00 dBm

1

Mkr1 2.412 GHz
8.872 dBm

Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 86.07 ms (1001 pts)

MARK	MODE	TRF	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	F	I	2.412 GHz	8.872 dBm			

Auto Tune

Center Freq
13.26500000 GHz

Start Freq
30.000000 GHz

Stop Freq
26.500000 GHz

CF Step
2.847000000 GHz

Auto Man

Freq Offset
0 Hz

Scale Type

Log Lin

MSIG (STATUS)

Keysight Spectrum Analyzer - Single SA

Start Freq 30.000000 MHz

Ref 30.00 dBm

Mkr1 2.412 GHz 8.813 dBm

Stop 30 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 86.07 ms (1001 pts)

Stop 26.50 GHz

MRK MODE TRC: SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE

MRK	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	S	F	2.412 GHz	8.813 dBm			

[illegible]

Keysight Spectrum Analyzer - Sweep SA

Start Freq 30.000000 MHz

PRN: Fast IF Gain: Low

Trig: Free Run

Att: 40 dB

Avg Type: Log-Pwr

Avg/Hold: >100/100

PRG: 3 2 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 9

Keylight Spectrum Analyzer - Sengul SA

Start Freq 30.000000 MHz

Ref 30.00 dBm

Mkr1 2.492 GHz 4.81 dBm

Start 30 MHz

Stop 26.50 GHz

Res BW 100 kHz

VBW 300 kHz

Sweep 86.07 ms (1001 pts)

Trace 1: 2.492 GHz 4.81 dBm

Function: SCL

Function Width: 100 kHz

Function Value: 4.81 dBm

Keysight Spectrum Analyzer - Swept SA

Start Freq 30.000000 MHz

PNO: Fast
IF Gain: Low

Trig: Free Run
Att'n: 40 dB

Avg Type: Log-Pwr
Res Hold: >100 Hz

04:05:48 PM Jun 23, 2018

TYPE: Channel
DEF: 2.492 GHz

Frequency

Auto Tune

Center Freq
13.265000000 GHz

Start Freq
30.000000 MHz

Stop Freq
26.500000 GHz

CF Step
2.647000000 GHz

Auto Man

Freq Offset
0 Hz

Scale Type
Log Lin

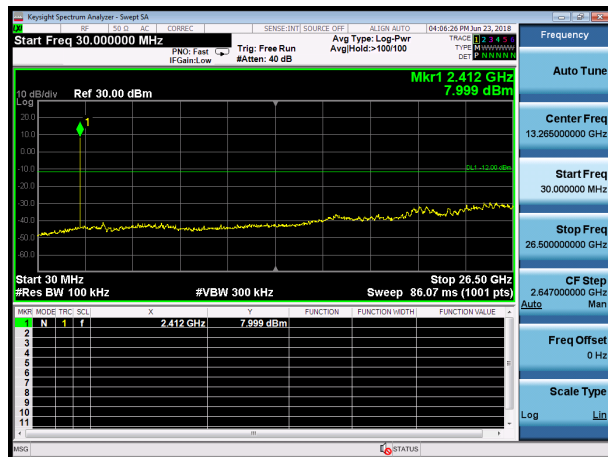
Log Lin

MSG

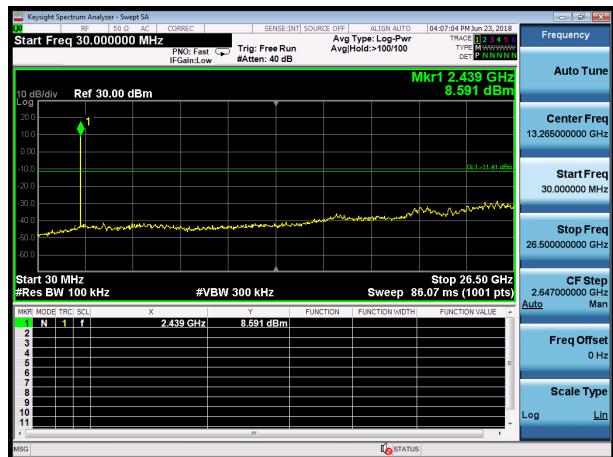
STATUS



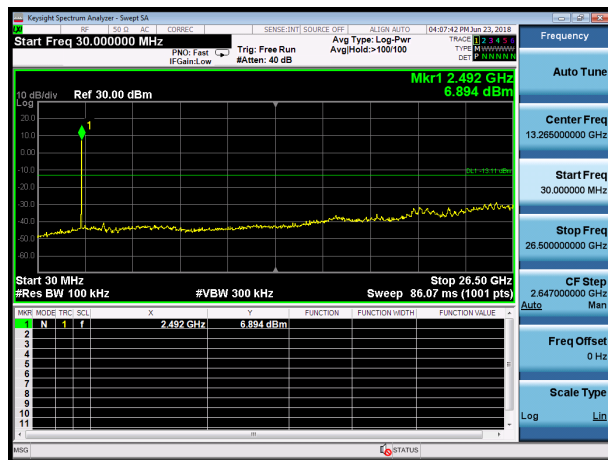
3DH5-CH0 30MHz to 26.5GHz



3DH5-CH39 30MHz to 26.5GHz



3DH5-CH78 30MHz to 26.5GHz



5.8 Unwanted Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. 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 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.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. 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.

Set the spectrum analyzer in the following:

Below 1GHz (detector: Peak and Quasi-Peak)

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz(detector: Peak):

(a) PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

The dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak- average correction factor, derived from the appropriate duty cycle calculation.

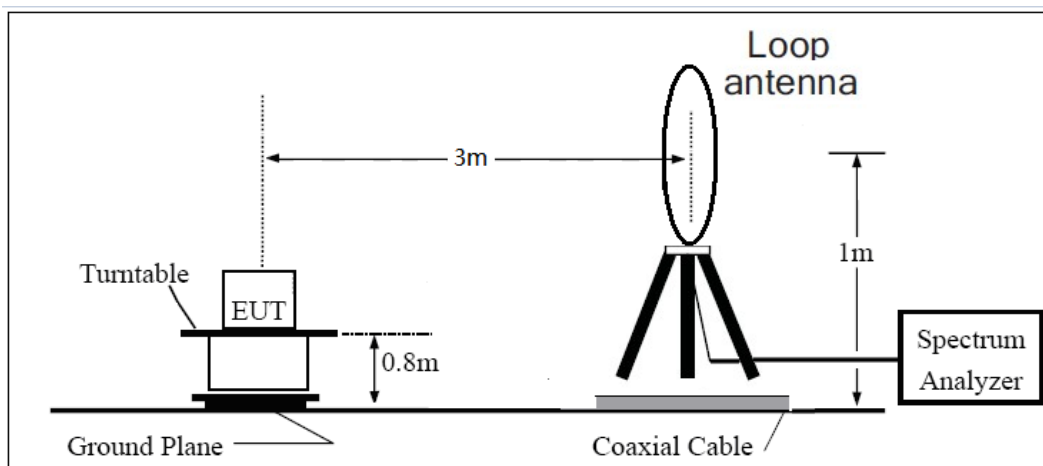
This setting method can refer to **DA00-705**.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded. Then this mode was measured in the following mode: EUT with cradle and EUT without cradle. The worst emission was found in EUT with cradle mode and the worst case was recorded.

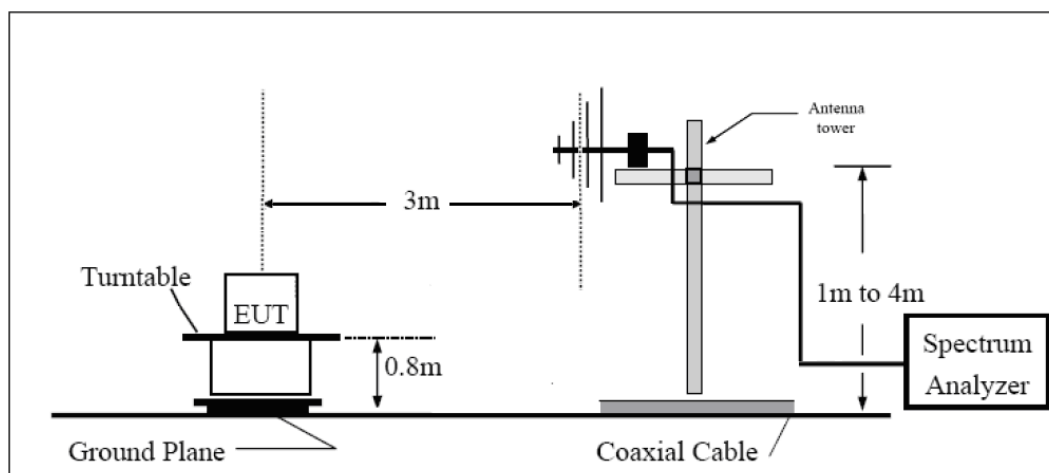
The test is in transmitting mode.

Test setup

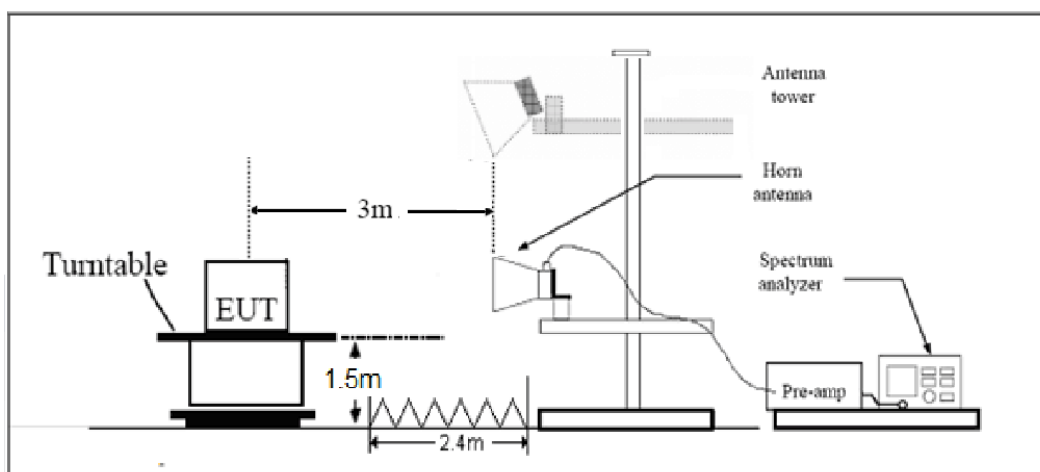
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



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(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
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=74dBuV/m

Average Limit=54dBuV/m

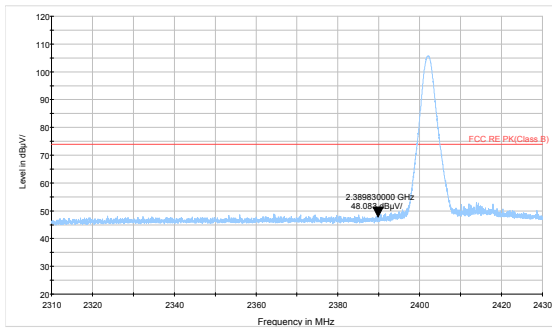
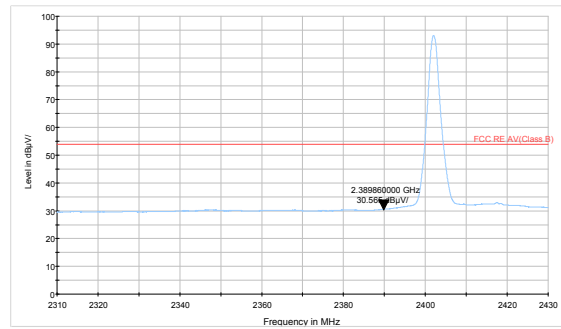
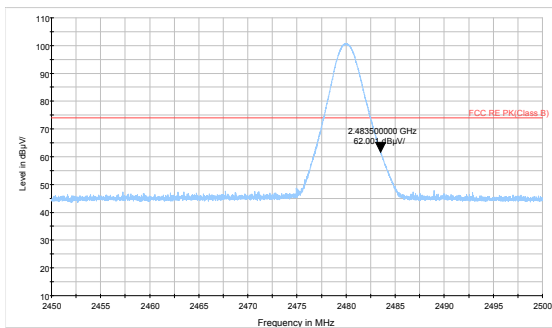
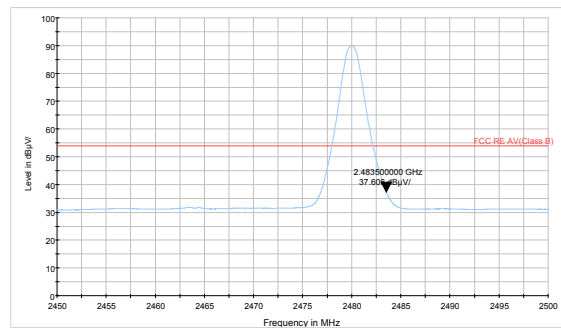
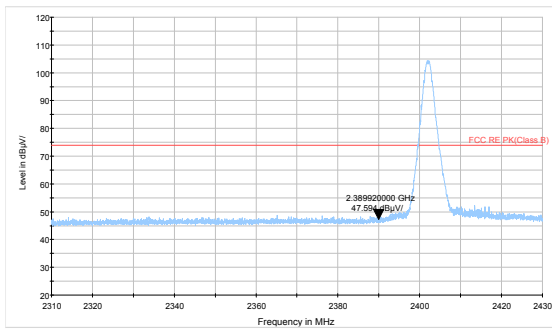
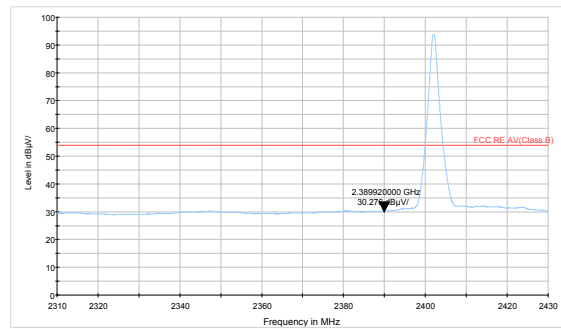
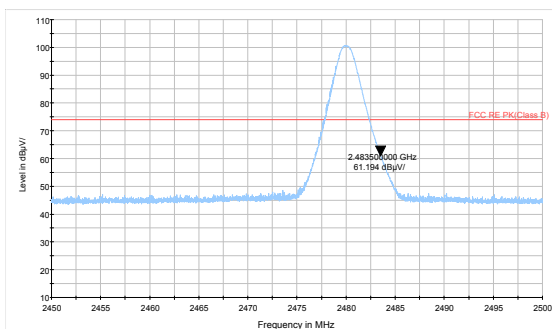
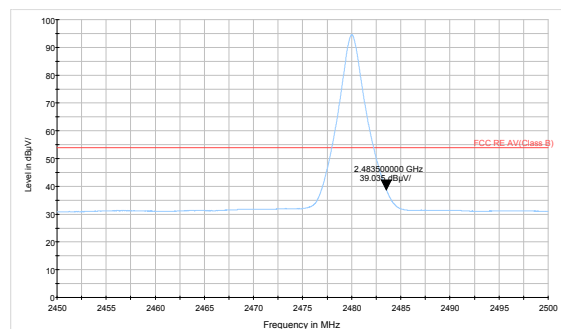
Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 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 $k = 1.96$.

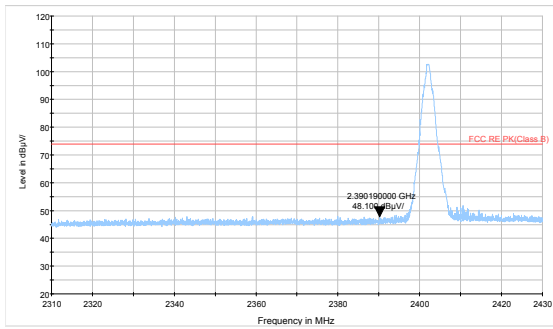
Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

**Test Results:****The signal beyond the limit is carrier.****EMCP (3GB+32GB)****DH5-Channel 0: Peak****DH5-Channel 0: Average****DH5-Channel 78: Peak****DH5-Channel 78: Average****3DH5-Channel 0: Peak****3DH5-Channel 0: Average****3DH5-Channel 78: Peak****3DH5-Channel 78: Average**

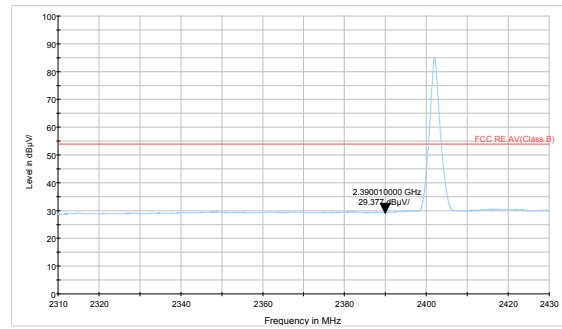


LPDDR3+eMMC (4GB+64GB)

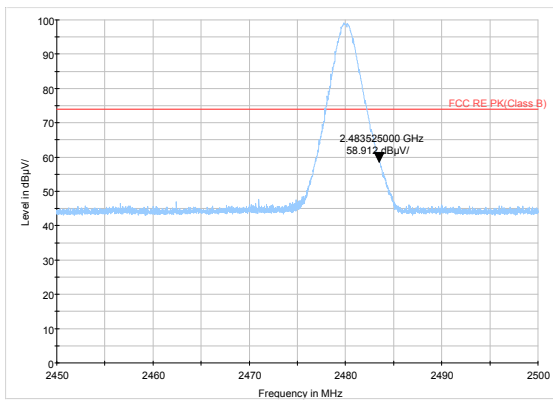
DH5-Channel 0: Peak



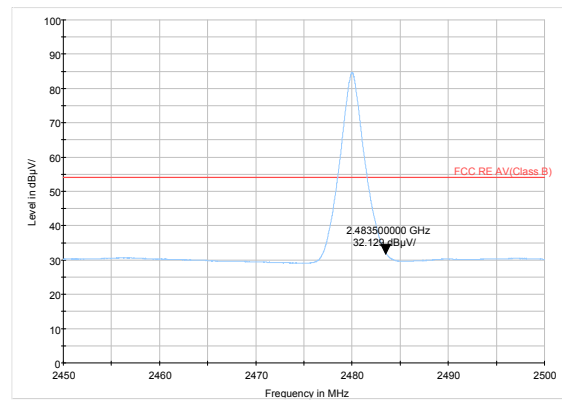
DH5-Channel 0: Average



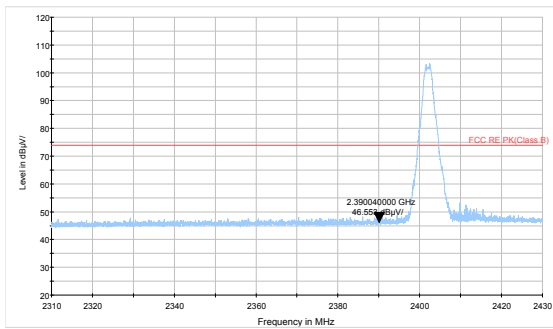
DH5-Channel 78: Peak



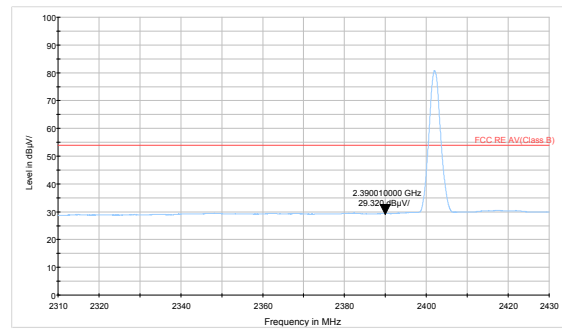
DH5-Channel 78: Average



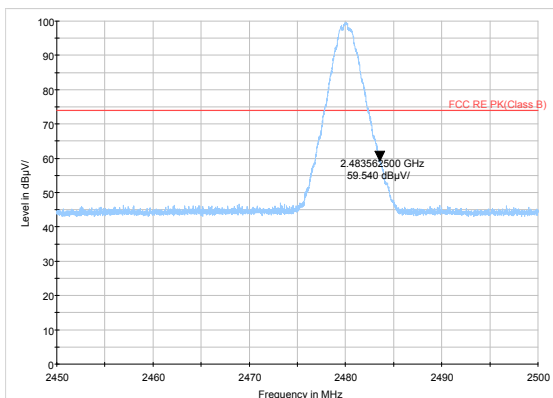
3DH5-Channel 0: Peak



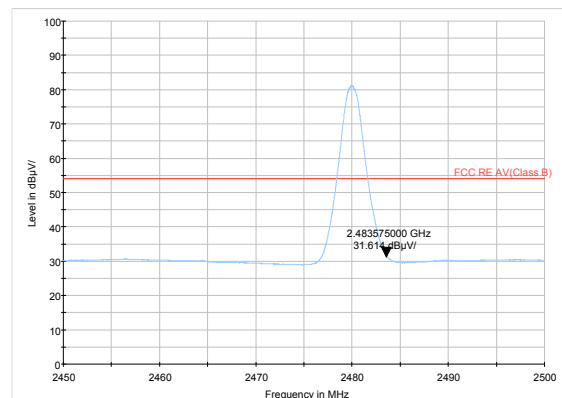
3DH5-Channel 0: Average



3DH5-Channel 78: Peak



3DH5-Channel 78: Average



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 and 18GHz-26.5GHz are more than 20dB below the limit are not reported.

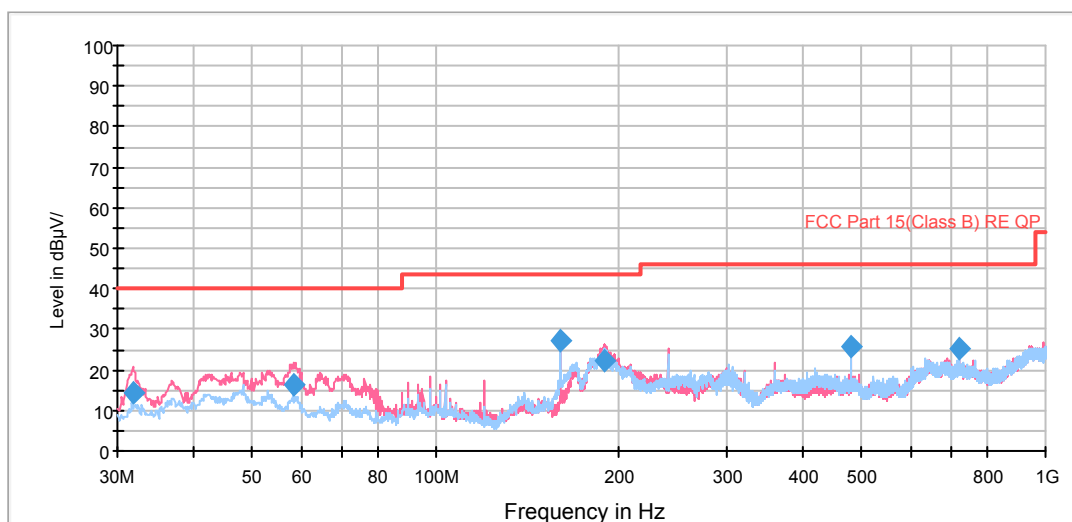
The following graphs display the maximum values of horizontal and vertical by software.
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

EMCP (3GB+32GB)

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, BT **GFSK Channel 0** are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Continuous TX mode:

RE 30M-1GHz QP



Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
31.859203	14.4	33.5	100.0	V	7.0	-19.1	25.6	40.0
58.346569	16.6	37.6	100.0	V	203.0	-21.0	23.4	40.0
159.980050	27.0	55.0	219.0	H	295.0	-28.0	16.5	43.5
189.210140	22.2	47.8	100.0	V	284.0	-25.6	21.3	43.5
480.000000	25.9	45.6	125.0	V	152.0	-19.7	20.1	46.0
719.993750	25.3	40.2	307.0	H	15.0	-14.9	20.7	46.0

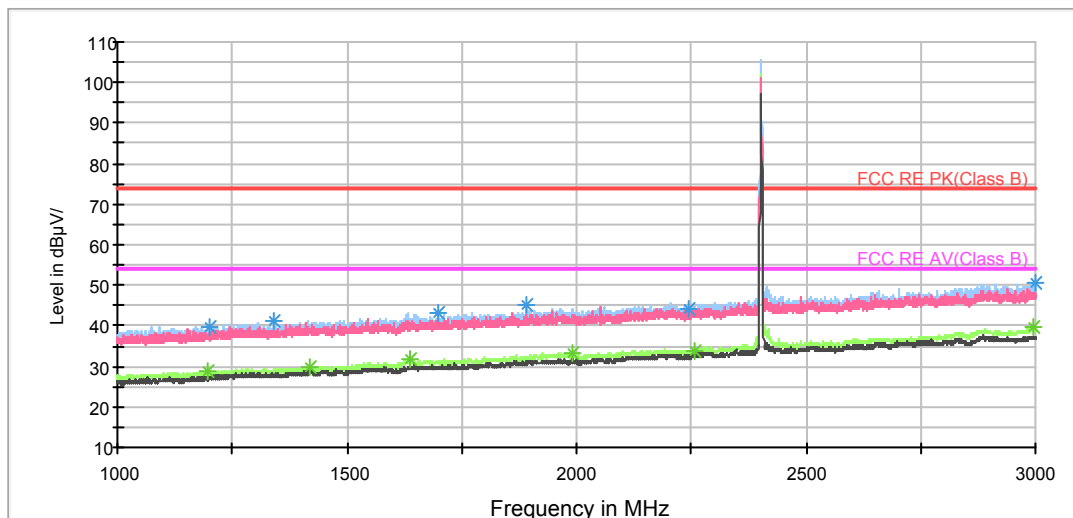
Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

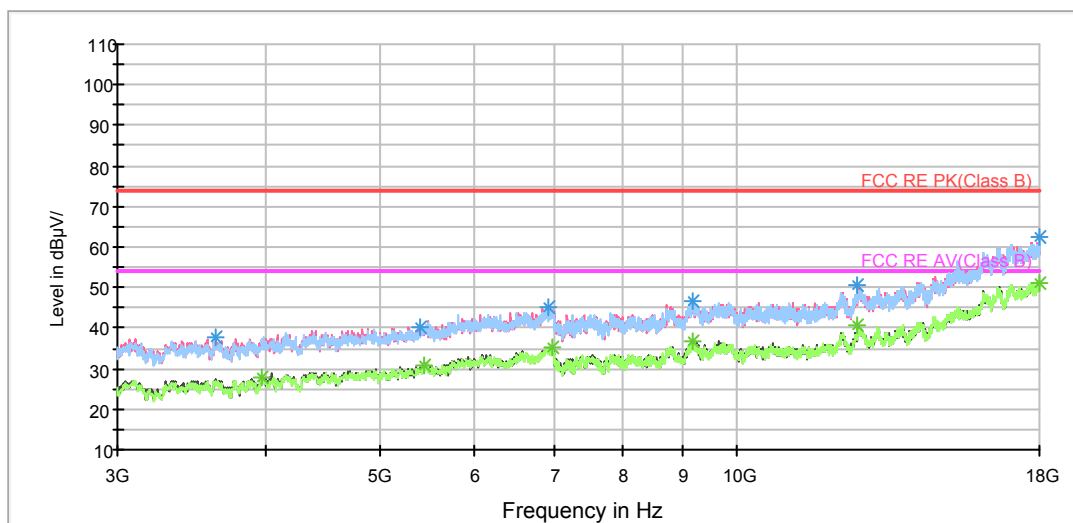
GFSK-Channel 0

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.750000	39.9	200.0	H	272.0	48.1	-8.2	34.1	74
1342.500000	41.4	200.0	H	7.0	48.9	-7.5	32.6	74
1700.250000	43.2	100.0	H	354.0	48.1	-4.9	30.8	74
1892.000000	45.3	100.0	H	0.0	49.5	-4.2	28.7	74
2246.250000	44.3	200.0	H	53.0	46.7	-2.4	29.7	74
2998.500000	50.8	200.0	H	0.0	48.5	2.3	23.2	74

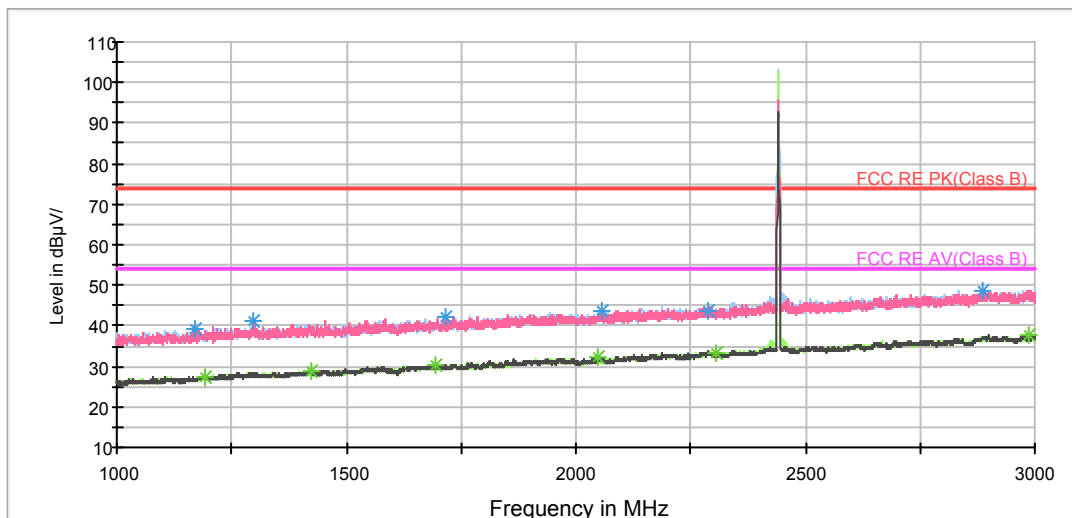
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1197.250000	28.6	200.0	H	172.0	36.8	-8.2	25.4	54
1420.000000	29.9	200.0	H	53.0	36.8	-6.9	24.1	54
1637.250000	31.6	200.0	H	59.0	36.3	-4.7	22.4	54
1992.500000	33.2	200.0	H	7.0	36.5	-3.3	20.8	54
2257.250000	34.0	200.0	H	131.0	36.1	-2.1	20.0	54
2994.250000	39.5	200.0	H	53.0	37.2	2.3	14.5	54

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

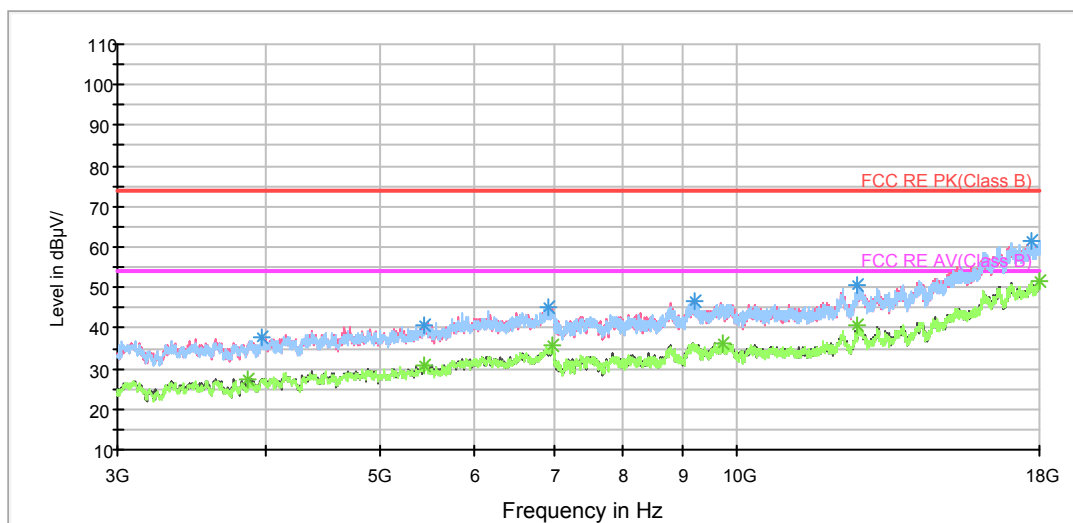
GFSK-Channel 39

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1171.000000	39.0	100.0	H	331.0	47.1	-8.1	35.0	74
1298.500000	41.0	100.0	V	325.0	48.8	-7.8	33.0	74
1717.000000	42.0	200.0	H	90.0	46.9	-4.9	32.0	74
2057.250000	43.6	200.0	V	326.0	46.8	-3.2	30.4	74
2286.250000	43.8	200.0	H	184.0	45.4	-1.6	30.2	74
2886.000000	48.8	200.0	V	0.0	46.6	2.2	25.2	74

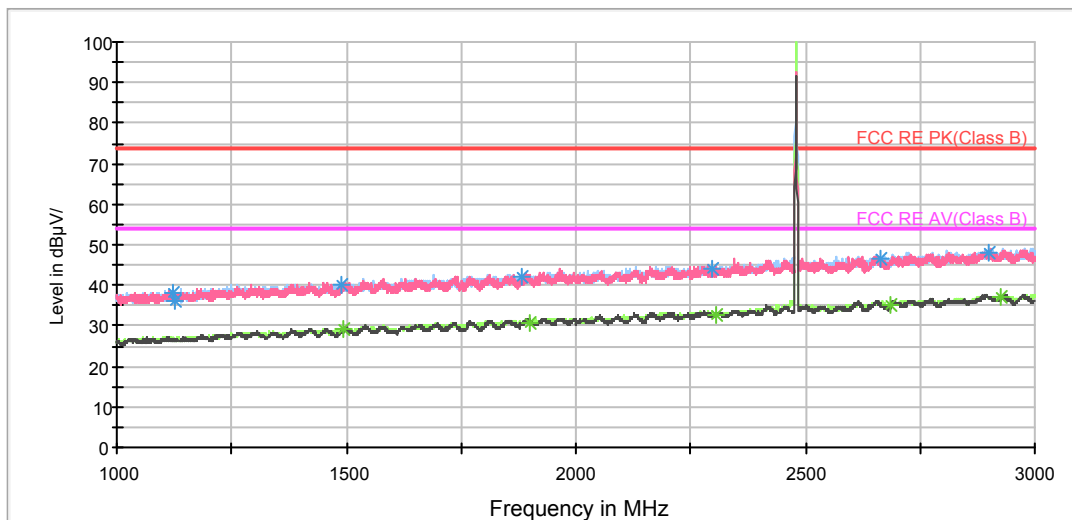
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1191.000000	27.5	100.0	H	244.0	35.7	-8.2	26.5	54
1425.750000	28.9	200.0	V	103.0	35.8	-6.9	25.1	54
1696.500000	30.2	200.0	H	0.0	35.2	-5.0	23.8	54
2047.000000	32.0	200.0	V	163.0	35.2	-3.2	22.0	54
2306.250000	33.1	100.0	H	179.0	35.1	-2.0	20.9	54
2986.250000	37.6	200.0	H	230.0	35.4	2.2	16.4	54

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

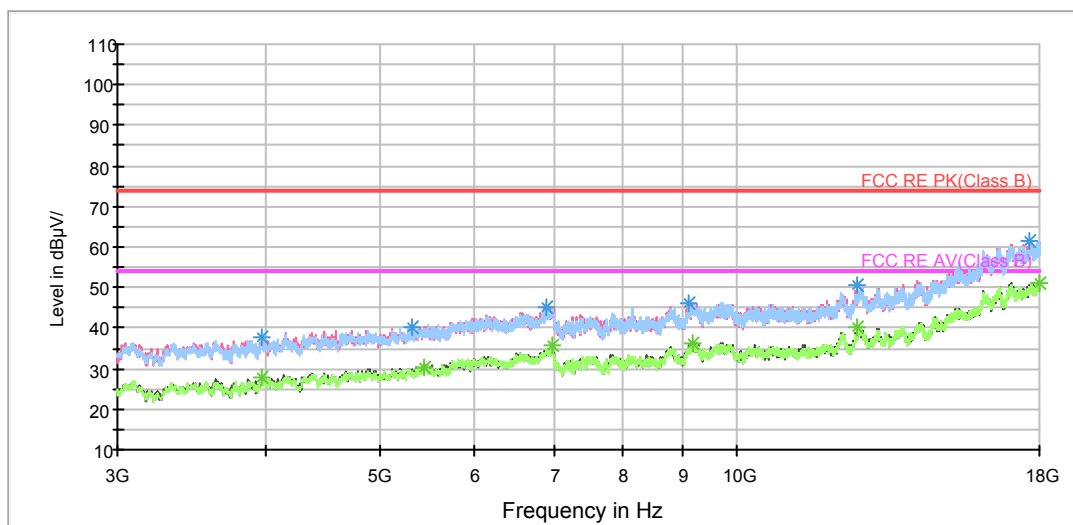
GFSK-Channel 78

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

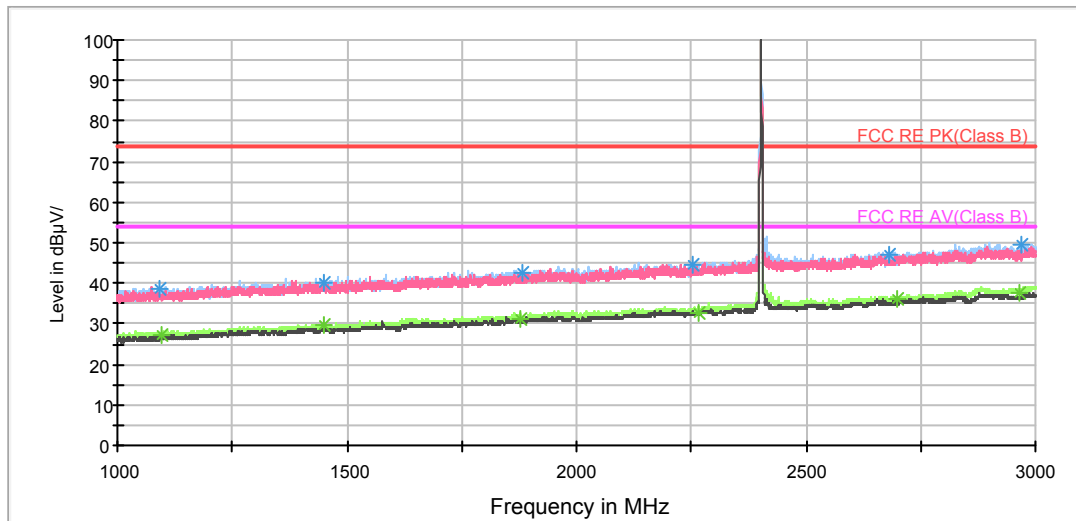
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1123.750000	38.2	200.0	H	24.0	46.7	-8.5	35.8	74
1488.000000	40.1	200.0	H	60.0	46.8	-6.7	33.9	74
1883.000000	42.3	100.0	H	313.0	46.5	-4.2	31.7	74
2298.500000	44.0	200.0	H	0.0	46.1	-2.1	30.0	74
2664.500000	46.7	400.0	H	36.0	46.4	0.3	27.3	74
2901.250000	48.0	400.0	H	0.0	46.0	2.0	26.0	74
1126.750000	35.9	300.0	H	300.0	44.3	-8.4	38.1	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1495.000000	29.1	400.0	H	222.0	35.8	-6.7	24.9	54
1901.250000	30.7	200.0	H	19.0	34.5	-3.8	23.3	54
2306.250000	32.7	300.0	H	61.0	34.7	-2.0	21.3	54
2686.500000	35.0	400.0	H	0.0	34.9	0.1	19.0	54
2927.750000	37.2	300.0	V	0.0	35.5	1.7	16.8	54

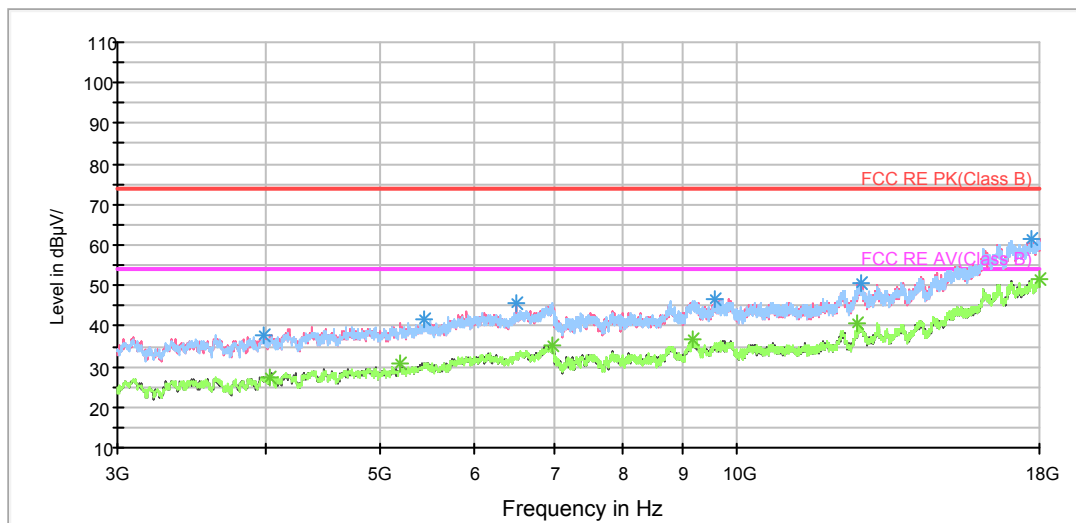
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

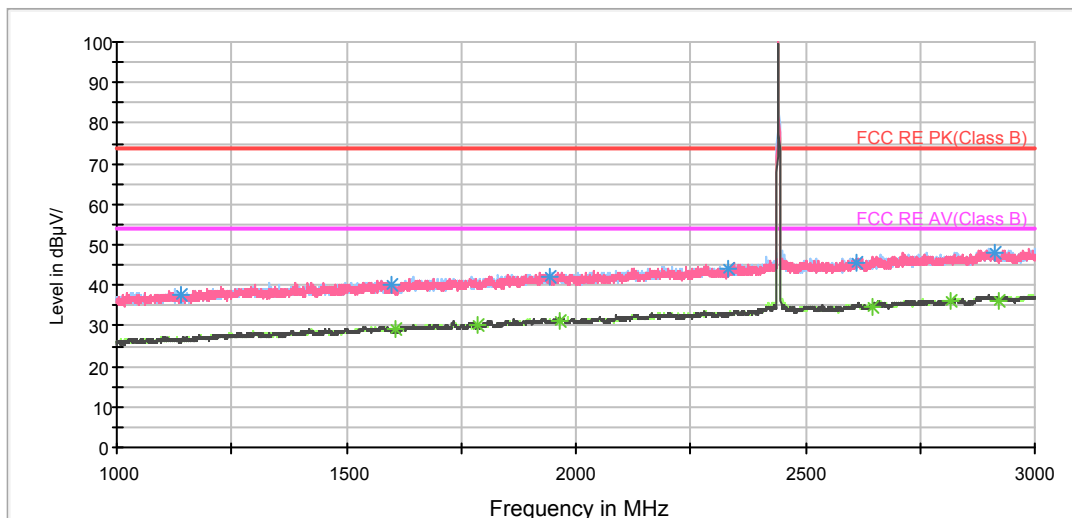
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1092.500000	38.6	100.0	H	0.0	47.5	-8.9	35.4	74
1451.750000	40.2	100.0	H	319.0	46.9	-6.7	33.8	74
1881.250000	42.6	100.0	H	357.0	46.8	-4.2	31.4	74
2255.250000	44.6	100.0	H	0.0	46.8	-2.2	29.4	74
2681.500000	46.9	100.0	H	338.0	46.7	0.2	27.1	74
2967.500000	49.3	100.0	H	0.0	47.1	2.2	24.7	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1097.000000	27.4	100.0	H	326.0	36.3	-8.9	26.6	54
1448.250000	29.5	100.0	H	357.0	36.2	-6.7	24.5	54
1879.250000	31.3	100.0	H	247.0	35.4	-4.1	22.7	54
2266.000000	32.8	200.0	V	346.0	34.6	-1.8	21.2	54
2699.750000	36.3	100.0	H	326.0	36.3	0.0	17.7	54
2967.000000	37.7	100.0	H	344.0	35.5	2.2	16.3	54

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

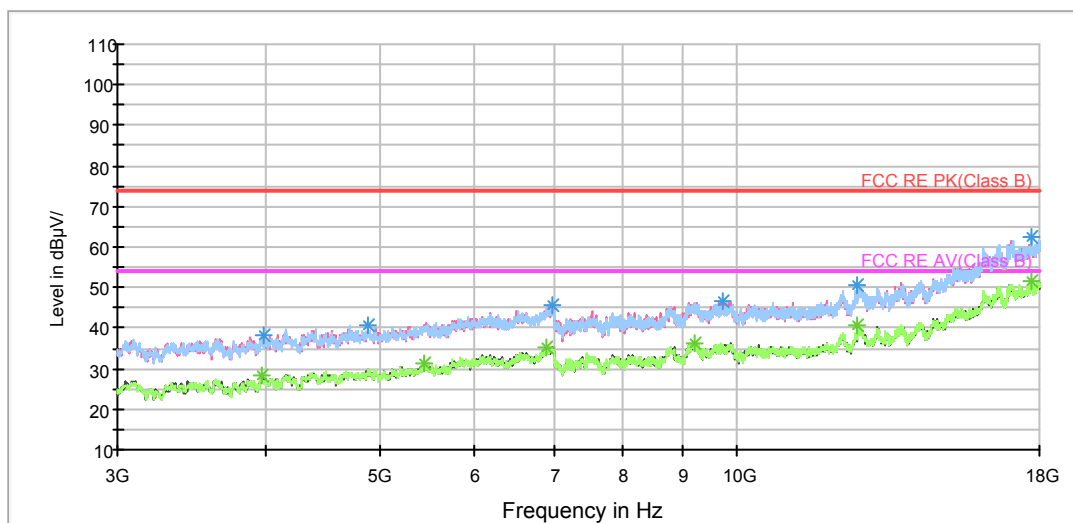
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

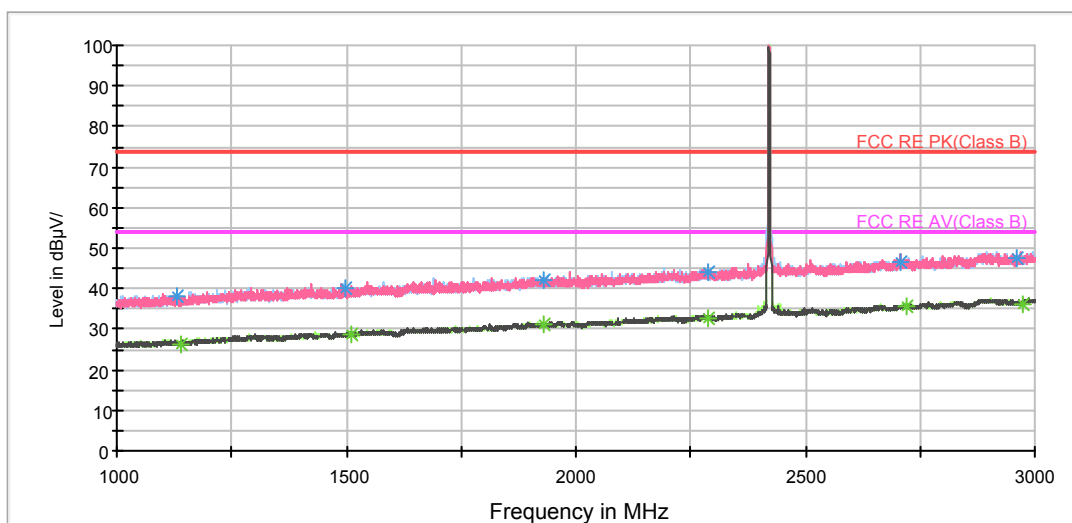
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1141.750000	37.5	100.0	H	236.0	46.0	-8.5	36.5	74
1599.750000	39.9	200.0	H	69.0	46.3	-6.4	34.1	74
1942.500000	42.0	200.0	H	131.0	45.5	-3.5	32.0	74
2330.250000	44.0	100.0	V	18.0	45.5	-1.5	30.0	74
2611.250000	45.7	100.0	H	53.0	45.6	0.1	28.3	74
2913.500000	48.0	200.0	H	0.0	46.2	1.8	26.0	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1606.250000	29.1	200.0	H	120.0	35.2	-6.1	24.9	54
1785.250000	30.3	100.0	H	0.0	34.7	-4.4	23.7	54
1963.500000	31.3	200.0	H	13.0	34.6	-3.3	22.7	54
2646.750000	34.9	100.0	H	76.0	34.6	0.3	19.1	54
2818.250000	36.1	100.0	H	293.0	34.6	1.5	17.9	54
2923.500000	36.3	200.0	H	80.0	34.6	1.7	17.7	54

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

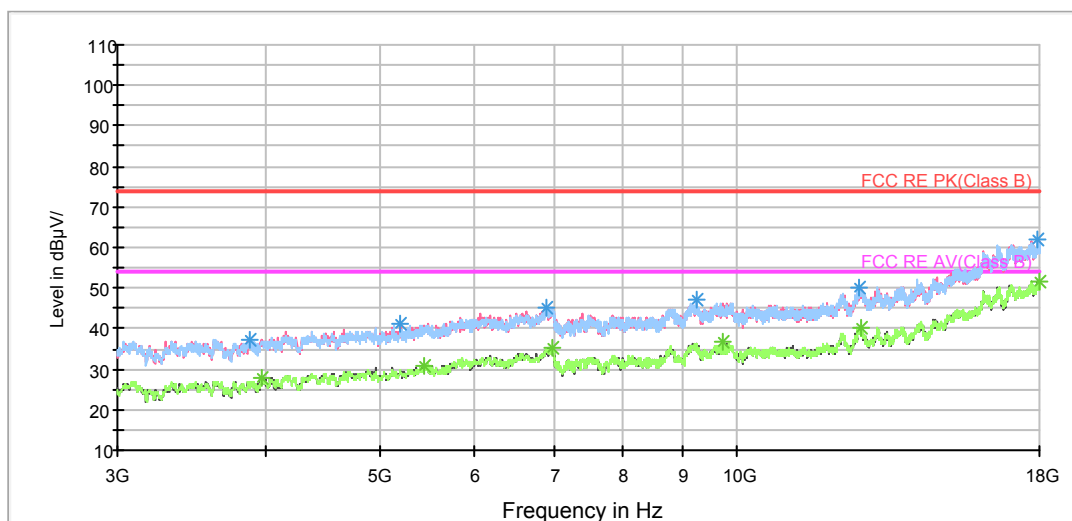
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1131.000000	38.1	200.0	H	142.0	46.5	-8.4	35.9	74
1499.000000	39.9	100.0	V	52.0	46.6	-6.7	34.1	74
1928.500000	41.9	200.0	H	3.0	45.6	-3.7	32.1	74
2287.500000	43.9	100.0	V	169.0	45.5	-1.6	30.1	74
2705.500000	46.5	200.0	H	0.0	46.4	0.1	27.5	74
2962.000000	47.5	200.0	H	165.0	45.4	2.1	26.5	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1140.500000	26.4	100.0	V	257.0	35.0	-8.6	27.6	54
1509.000000	28.7	200.0	H	107.0	35.2	-6.5	25.3	54
1928.500000	31.1	200.0	H	3.0	34.8	-3.7	22.9	54
2289.500000	32.7	200.0	H	0.0	34.4	-1.7	21.3	54
2721.250000	35.5	100.0	H	198.0	35.2	0.3	18.5	54
2972.000000	36.2	100.0	H	233.0	34.0	2.2	17.8	54

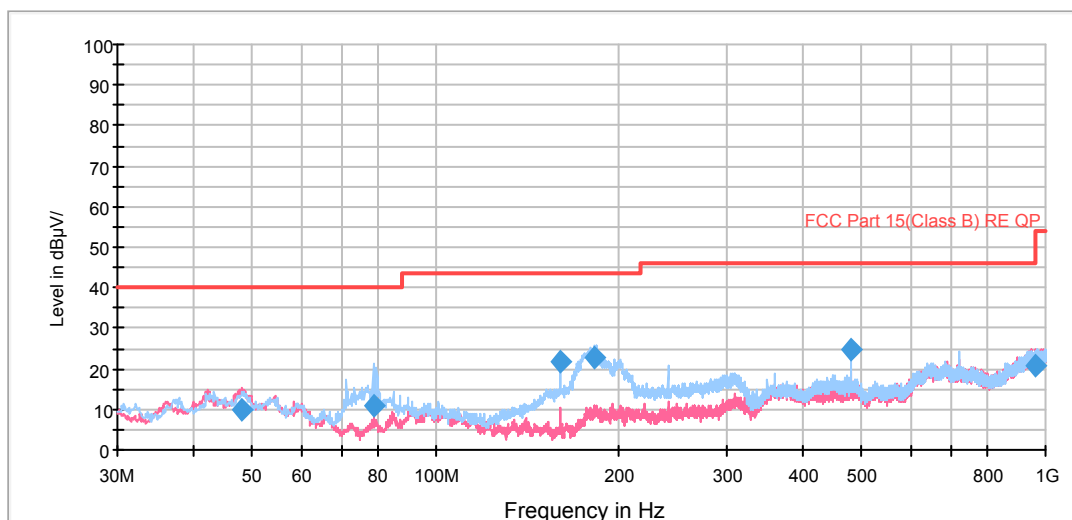
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

LPDDR3+eMMC (4GB+64GB)

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, BT **GFSK Channel 0** are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Continuous TX mode:

RE 30M-1GHz QP



Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
48.146084	10.0	28.1	125.0	V	79.0	-18.1	30.0	40.0
78.906590	10.7	37.1	225.0	H	301.0	-26.4	29.3	40.0
159.980050	21.5	49.5	175.0	H	124.0	-28.0	22.0	43.5
182.556169	22.9	50.0	121.0	H	110.0	-27.1	20.6	43.5
480.000000	24.9	44.6	175.0	H	170.0	-19.7	21.1	46.0
959.985500	20.9	31.6	100.0	V	193.0	-10.7	25.1	46.0

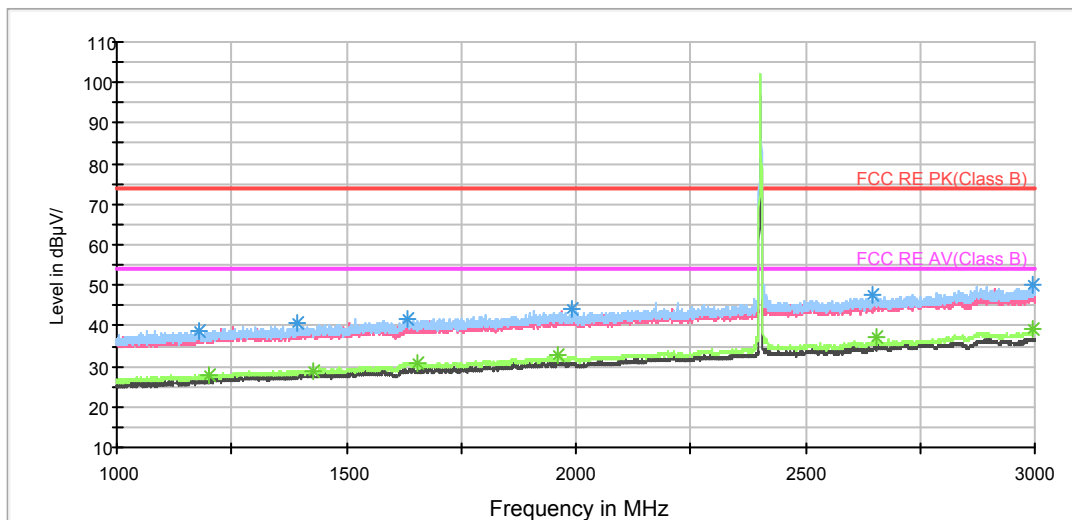
Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

GFSK-Channel 0

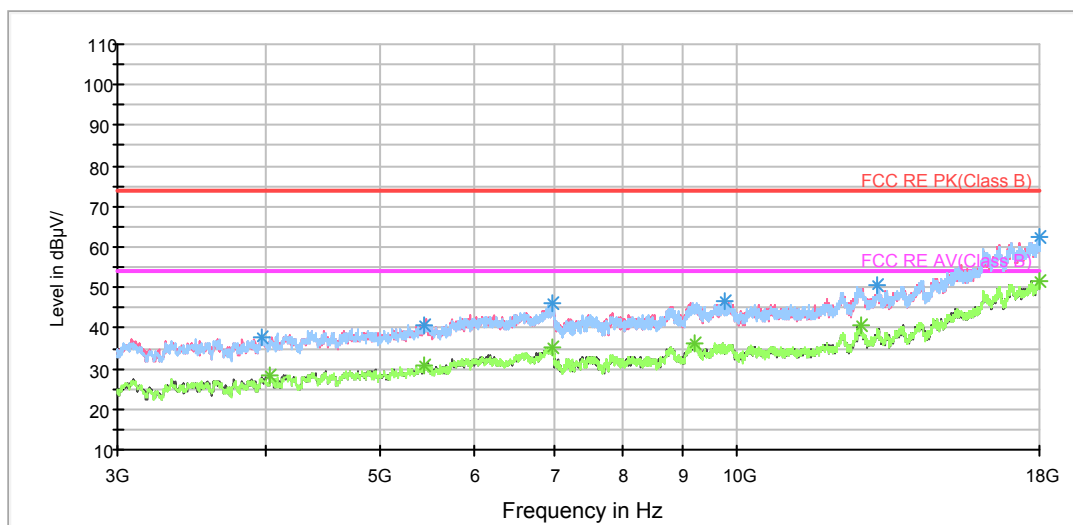
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1180.500000	38.7	100.0	H	16.0	46.7	-8.0	35.3	74
1391.000000	40.5	100.0	H	92.0	47.5	-7.0	33.5	74
1634.250000	41.8	100.0	H	92.0	46.5	-4.7	32.2	74
1991.500000	44.0	100.0	H	58.0	47.3	-3.3	30.0	74
2644.750000	47.4	100.0	H	46.0	47.1	0.3	26.6	74
2996.750000	50.1	100.0	H	69.0	47.8	2.3	23.9	74

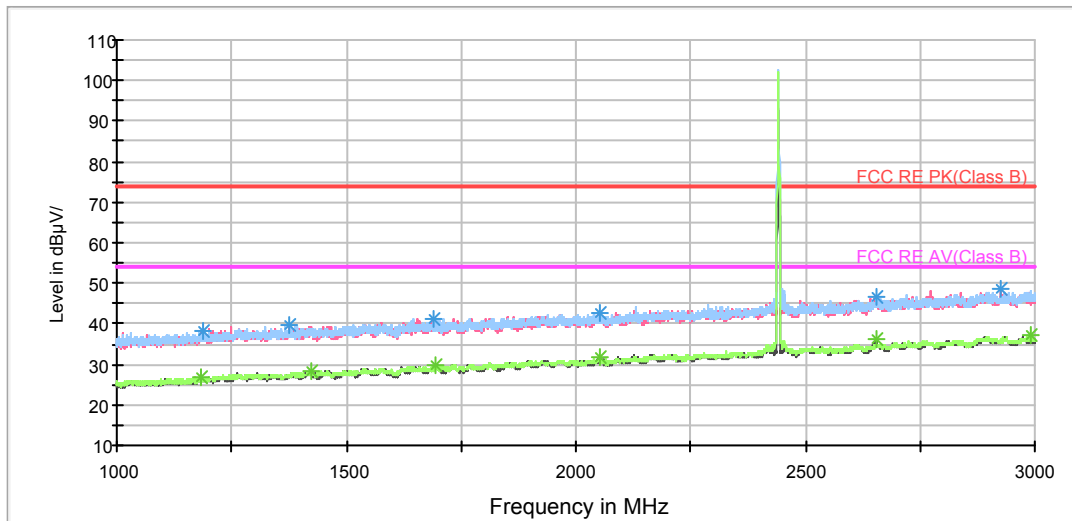
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.750000	27.7	100.0	H	69.0	35.9	-8.2	26.3	54
1426.000000	29.0	100.0	H	28.0	35.9	-6.9	25.0	54
1654.000000	31.0	100.0	H	46.0	36.1	-5.1	23.0	54
1958.750000	32.6	100.0	H	16.0	35.8	-3.2	21.4	54
2656.750000	37.0	100.0	H	116.0	36.6	0.4	17.0	54
2995.250000	39.2	100.0	H	0.0	36.9	2.3	14.8	54

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

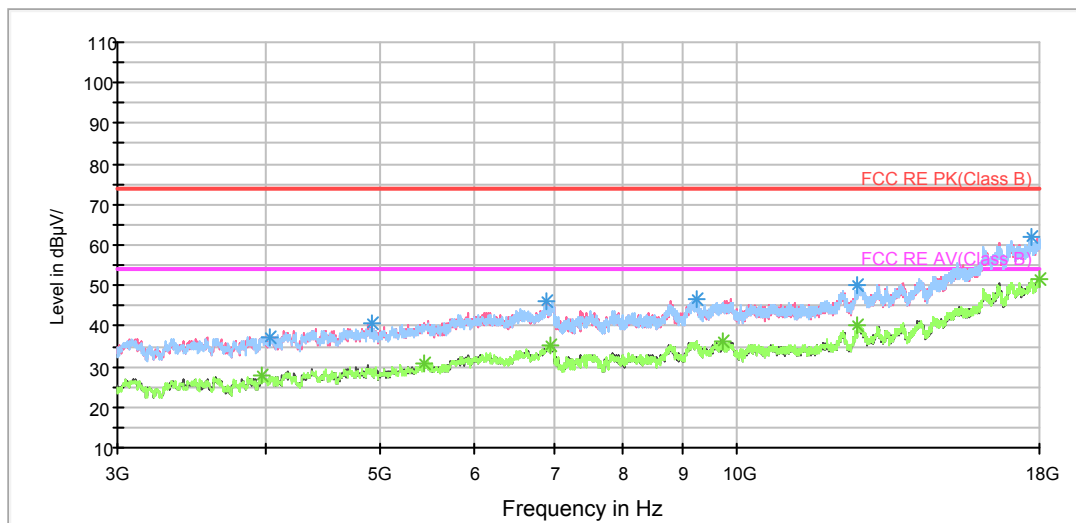
GFSK-Channel 39

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.500000	38.3	100.0	H	21.0	46.4	-8.1	35.7	74
1376.750000	39.8	100.0	V	311.0	46.9	-7.1	34.2	74
1691.000000	41.2	100.0	V	305.0	46.2	-5.0	32.8	74
2054.250000	42.7	100.0	V	311.0	45.9	-3.2	31.3	74
2657.000000	46.4	200.0	V	0.0	46.0	0.4	27.6	74
2927.000000	48.8	100.0	V	246.0	47.1	1.7	25.2	74

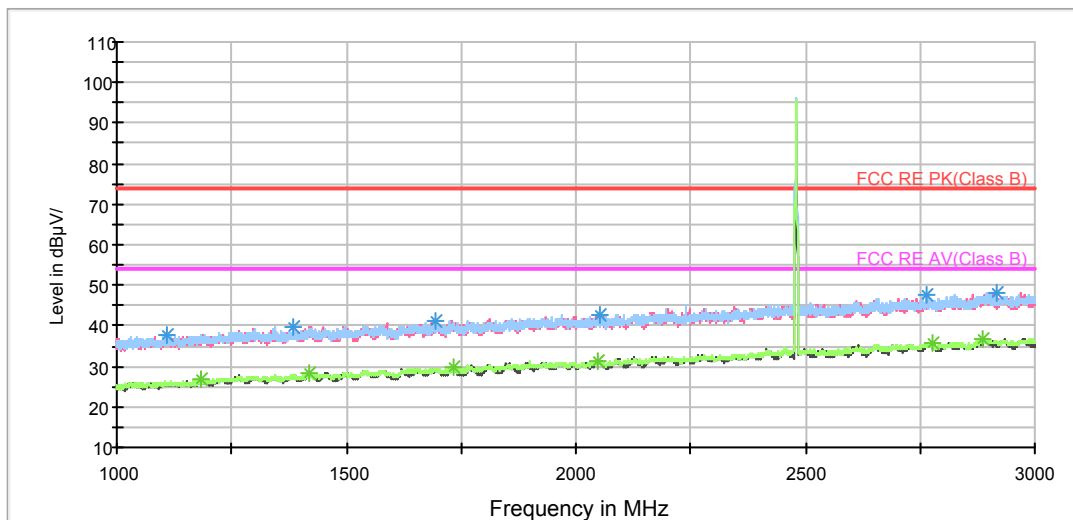
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1185.500000	26.7	200.0	V	0.0	34.8	-8.1	27.3	54
1423.250000	28.2	100.0	V	0.0	35.1	-6.9	25.8	54
1694.000000	29.8	100.0	V	0.0	34.8	-5.0	24.2	54
2053.500000	31.6	100.0	V	118.0	34.8	-3.2	22.4	54
2655.250000	36.1	100.0	V	183.0	35.7	0.4	17.9	54
2993.250000	37.0	100.0	H	44.0	34.8	2.2	17.0	54

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

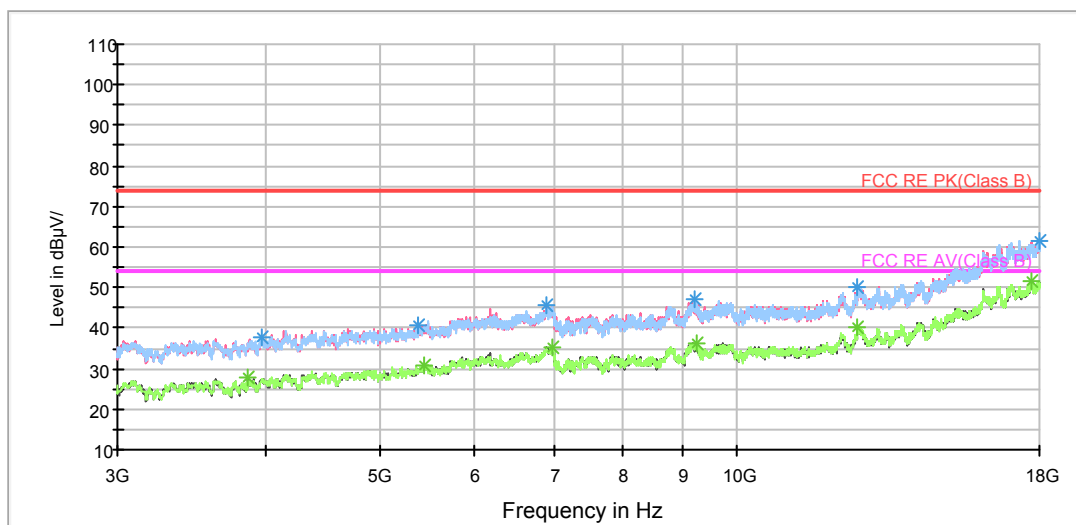
GFSK-Channel 78

RE 1G-3GHz PK+AV



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

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

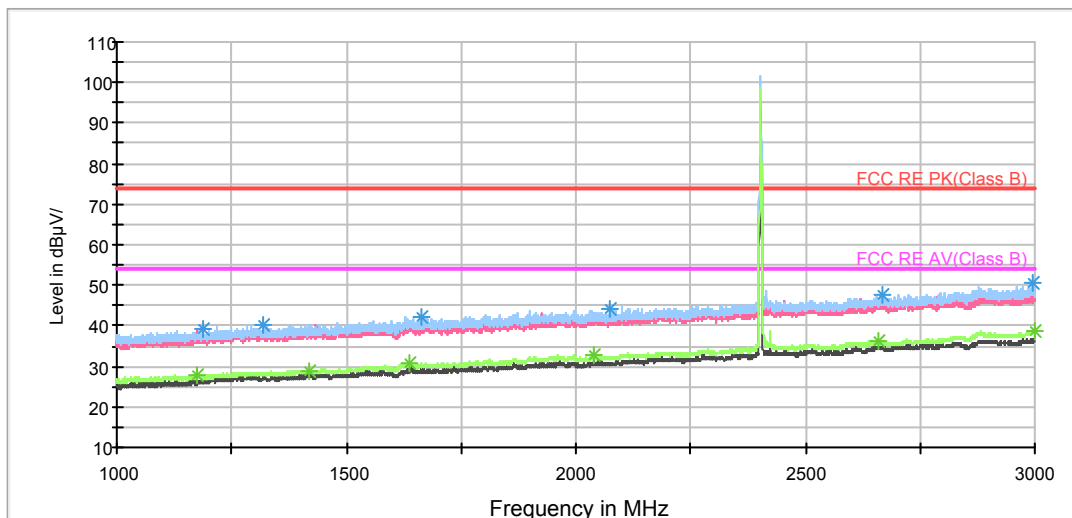
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1108.750000	37.8	100.0	V	60.0	46.5	-8.7	36.2	74
1383.750000	39.8	100.0	H	31.0	46.8	-7.0	34.2	74
1696.250000	41.1	200.0	V	189.0	46.1	-5.0	32.9	74
2052.500000	42.8	100.0	H	326.0	46.0	-3.2	31.2	74
2762.750000	47.8	100.0	H	65.0	46.9	0.9	26.2	74
2918.750000	48.4	200.0	H	342.0	46.6	1.8	25.6	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1182.500000	26.8	100.0	H	36.0	34.8	-8.0	27.2	54
1419.250000	28.3	100.0	V	0.0	35.2	-6.9	25.7	54
1732.000000	29.6	200.0	H	104.0	34.4	-4.8	24.4	54
2048.750000	31.4	100.0	V	156.0	34.6	-3.2	22.6	54
2776.250000	35.6	200.0	H	0.0	34.8	0.8	18.4	54
2887.250000	36.9	100.0	H	31.0	34.7	2.2	17.1	54

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

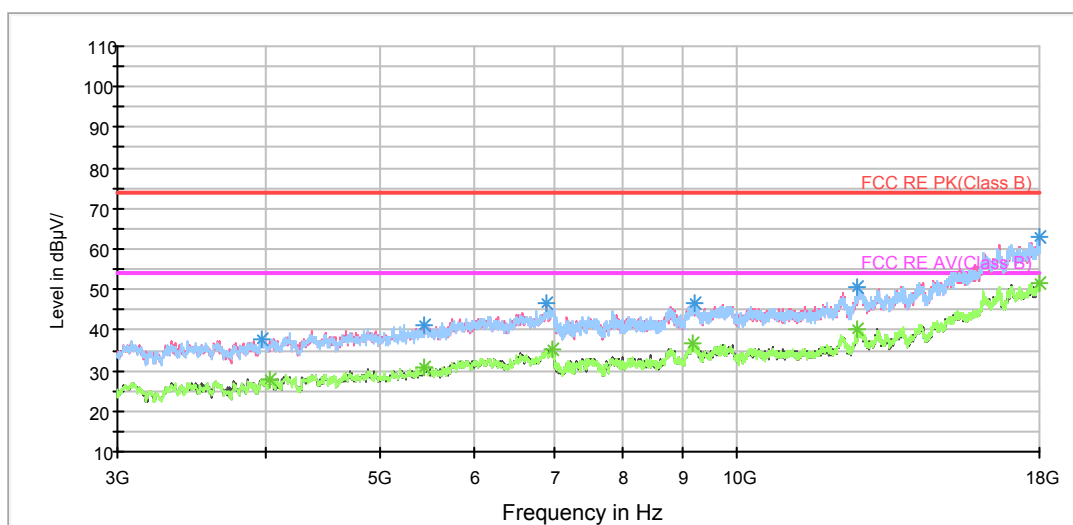
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

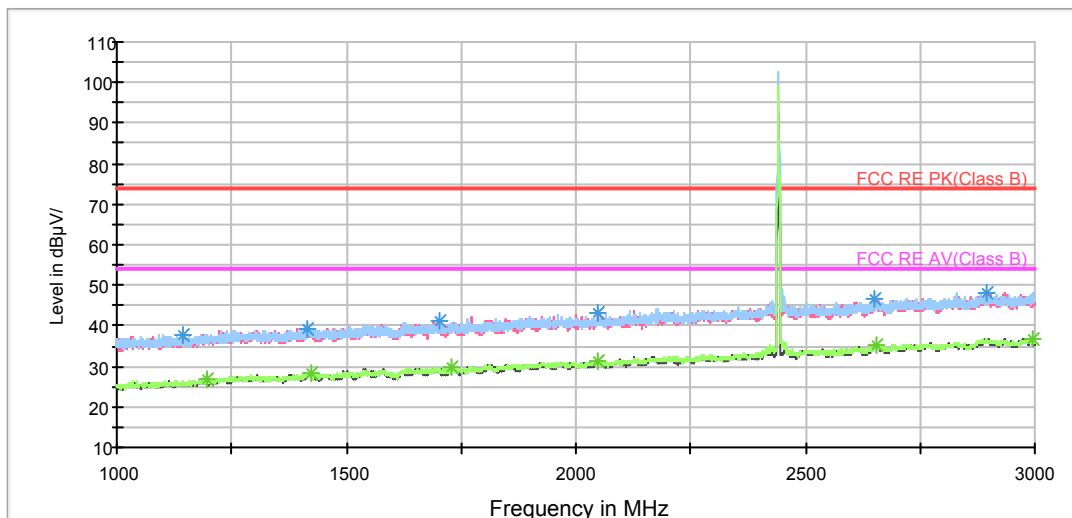
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1188.500000	39.2	100.0	H	44.0	47.4	-8.2	34.8	74
1317.500000	40.3	100.0	H	147.0	47.7	-7.4	33.7	74
1664.000000	42.1	200.0	H	320.0	47.3	-5.2	31.9	74
2074.250000	43.9	200.0	H	338.0	47.0	-3.1	30.1	74
2669.250000	47.6	200.0	H	349.0	47.3	0.3	26.4	74
2993.500000	50.6	100.0	H	2.0	48.4	2.2	23.4	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1173.750000	27.9	100.0	H	160.0	36.0	-8.1	26.1	54
1420.750000	29.0	100.0	H	91.0	35.9	-6.9	25.0	54
1639.000000	30.9	100.0	H	26.0	35.6	-4.7	23.1	54
2039.000000	32.7	200.0	H	332.0	35.9	-3.2	21.3	54
2660.250000	36.3	100.0	H	14.0	35.9	0.4	17.7	54
3000.000000	38.8	100.0	H	2.0	36.5	2.3	15.2	54

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

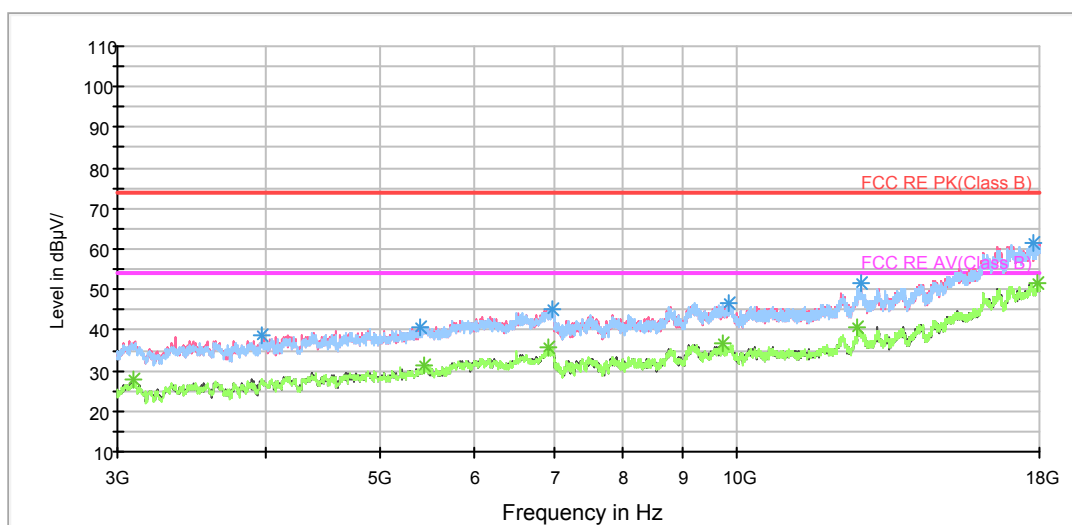
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

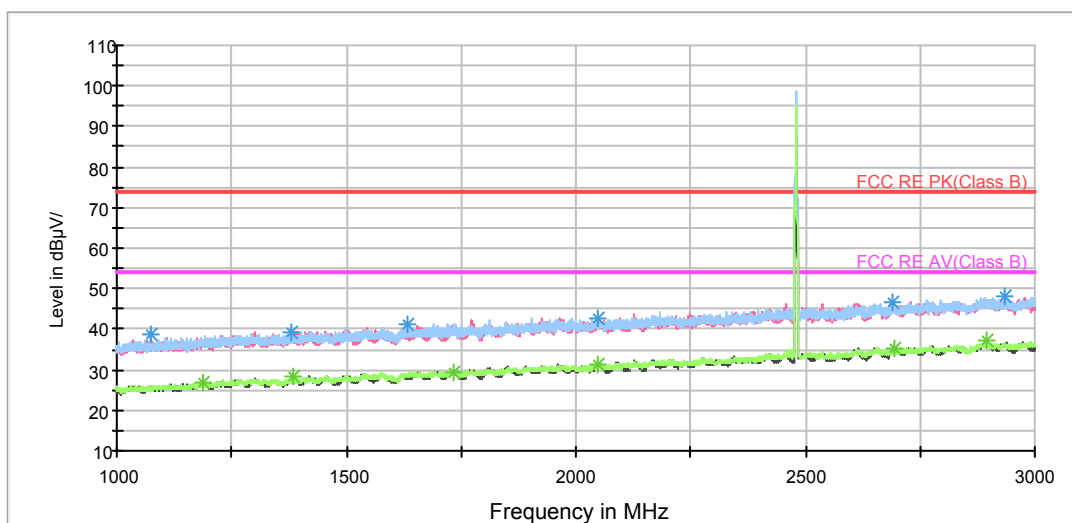
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1145.000000	38.0	100.0	V	54.0	46.5	-8.5	36.0	74
1414.500000	39.4	200.0	H	263.0	46.4	-7.0	34.6	74
1703.500000	41.3	200.0	V	23.0	46.2	-4.9	32.7	74
2049.500000	43.0	100.0	V	298.0	46.2	-3.2	31.0	74
2652.250000	46.7	200.0	V	91.0	46.3	0.4	27.3	74
2894.000000	48.1	200.0	H	169.0	46.0	2.1	25.9	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.500000	27.0	100.0	H	59.0	35.2	-8.2	27.0	54
1421.500000	28.5	200.0	V	103.0	35.4	-6.9	25.5	54
1731.250000	29.8	200.0	H	62.0	34.7	-4.9	24.2	54
2047.500000	31.3	200.0	V	197.0	34.5	-3.2	22.7	54
2656.750000	35.2	200.0	H	134.0	34.8	0.4	18.8	54
2994.750000	36.8	100.0	H	47.0	34.5	2.3	17.2	54

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

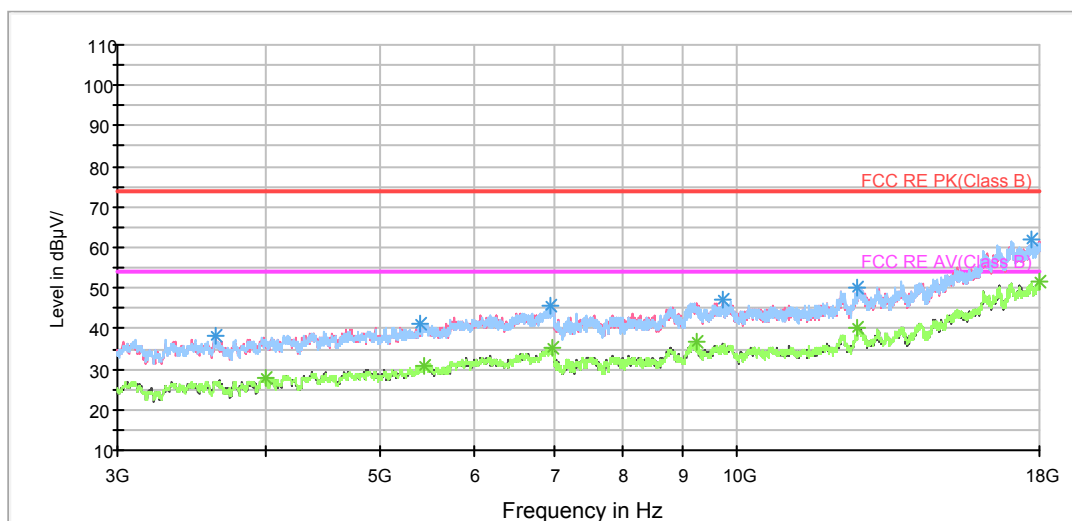
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1072.250000	38.5	200.0	H	0.0	47.3	-8.8	35.5	74
1380.250000	39.4	200.0	V	53.0	46.4	-7.0	34.6	74
1632.250000	41.4	100.0	H	0.0	46.1	-4.7	32.6	74
2049.500000	42.6	100.0	V	232.0	45.8	-3.2	31.4	74
2690.750000	46.5	200.0	H	156.0	46.4	0.1	27.5	74
2933.250000	48.1	200.0	V	0.0	46.3	1.8	25.9	74

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

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.000000	26.8	200.0	H	310.0	34.9	-8.1	27.2	54
1383.750000	28.4	100.0	V	150.0	35.4	-7.0	25.6	54
1732.000000	29.5	200.0	H	196.0	34.3	-4.8	24.5	54
2048.000000	31.4	200.0	V	81.0	34.6	-3.2	22.6	54
2693.500000	35.1	100.0	V	161.0	35.0	0.1	18.9	54
2897.000000	37.2	200.0	H	168.0	35.1	2.1	16.8	54

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

5.9 Conducted Emission

Ambient condition

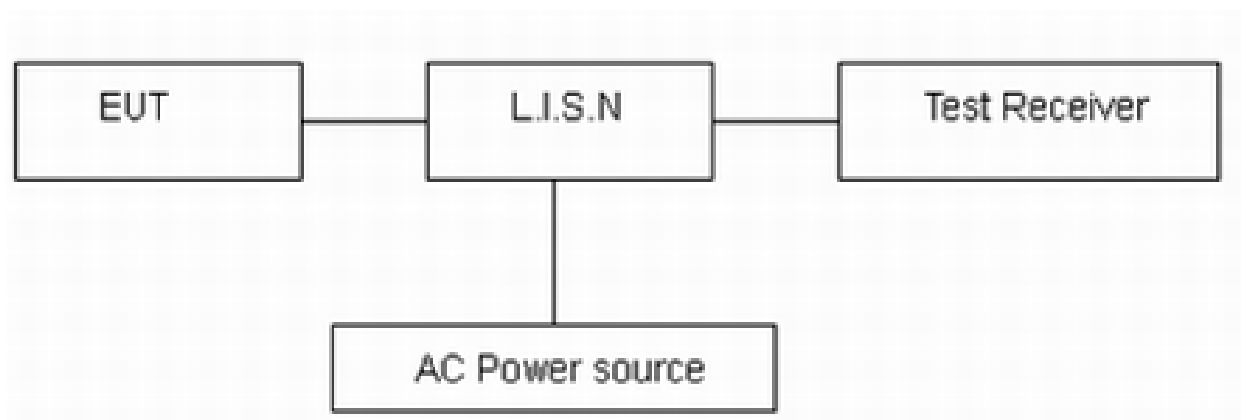
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 C63.10-2013. 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 120V/60Hz.

Limits

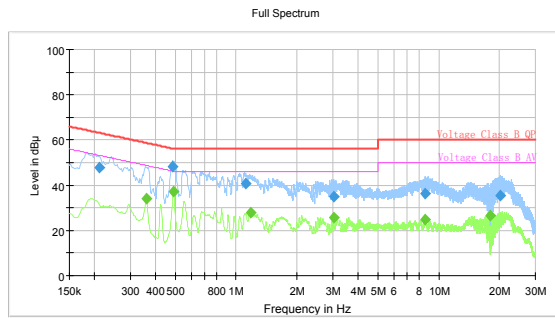
Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46 *
0.5 - 5	56	46
5 - 30	60	50
*: Decreases with the logarithm of the frequency.		

Measurement Uncertainty

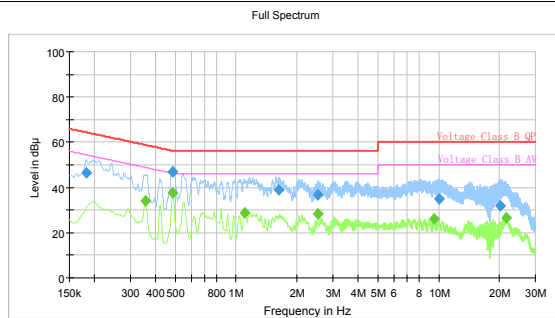
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=2.69$ dB.

**Test Results:**

Following plots, Blue trace uses the peak detection, Green trace uses the average detection. During the test, the Conducted Emission was performed in all modes with all channels, BT **GFSK channel0**, are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

L Line

Frequency (MHz)	QuasiPeak (dB μV)	Average (dB μV)	Limit (dB μV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.210750	47.57	---	63.18	15.60	1000.0	9.000	L1	ON	19.2
0.359250	---	34.11	48.75	14.63	1000.0	9.000	L1	ON	19.2
0.485250	48.17	---	56.25	8.08	1000.0	9.000	L1	ON	19.2
0.489750	---	36.97	46.17	9.21	1000.0	9.000	L1	ON	19.2
1.113000	40.51	---	56.00	15.49	1000.0	9.000	L1	ON	19.2
1.180500	---	27.66	46.00	18.34	1000.0	9.000	L1	ON	19.2
3.021000	---	25.51	46.00	20.49	1000.0	9.000	L1	ON	19.1
3.043500	35.01	---	56.00	20.99	1000.0	9.000	L1	ON	19.1
8.553750	36.36	---	60.00	23.64	1000.0	9.000	L1	ON	19.2
17.949750	---	24.85	50.00	25.15	1000.0	9.000	L1	ON	19.2
20.096250	35.35	---	60.00	24.65	1000.0	9.000	L1	ON	19.7

N Line

Frequency (MHz)	QuasiPeak (dB μV)	Average (dB μV)	Limit (dB μV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.181500	46.47	---	64.42	17.95	1000.0	9.000	N	ON	19.2
0.357000	---	34.25	48.80	14.55	1000.0	9.000	N	ON	19.2
0.487500	---	37.57	46.21	8.64	1000.0	9.000	N	ON	19.2
0.487500	46.99	---	56.21	9.22	1000.0	9.000	N	ON	19.2
1.104000	---	28.91	46.00	17.09	1000.0	9.000	N	ON	19.2
1.623750	39.10	---	56.00	16.90	1000.0	9.000	N	ON	19.2
2.530500	---	28.24	46.00	17.76	1000.0	9.000	N	ON	19.0
2.539500	36.69	---	56.00	19.31	1000.0	9.000	N	ON	19.0
9.485250	---	26.17	50.00	23.83	1000.0	9.000	N	ON	19.3
10.034250	35.14	---	60.00	24.86	1000.0	9.000	N	ON	19.4
20.069250	31.80	---	60.00	28.20	1000.0	9.000	N	ON	19.5
21.437250	---	26.33	50.00	23.67	1000.0	9.000	N	ON	19.5

6 Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
BT Base Station Simulator	R&S	CBT	100271	2018-05-20	2019-05-19
Loop Antenna	Schwarzbeck	FMZB1519	1519-047	2017-02-18	2020-02-17
EMI Test Receiver	R&S	ESR	101667	2017-09-06	2018-09-05
LISN	R&S	ENV216	101171	2016-12-16	2019-12-15
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-201	2017-11-18	2020-11-17
Double Ridged Waveguide Horn Antenna	R&S	HF907	100126	2014-12-06	2019-12-05
Spectrum Analyzer	Agilent	N9010A	MY47191109	2018-05-20	2019-05-19
Standard Gain Horn	ETS-Lindgren	3160-09	00102644	2015-01-30	2020-01-29
RF Cable	Agilent	SMA 15cm	0001	/	/
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Software (CE)	R&S	EMC32	9.26.0	/	/
Software (RE/RSE)	R&S	EMC32	8.52.0	/	/

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