KSIGN(Guangdong) Testing Co, Ltd.

First Floor West Side, Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu Village, Shatou Community, Shajing Street, Bao'an District, Shenzhen City, Guangdong Province, P. R. China
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TEST REPORT

Report No.....:	**KS2003S00020E**
FCC ID.....:	**2ATQ9-K2**
Applicant.....:	Dongguan Gorsun Electronics Co.,Ltd
Address.....:	No.140 Chashi Road, Tangjiao Village, Chashan Town, Dongguan, China
Manufacturer.....:	Dongguan Gorsun Electronics Co.,Ltd
Address.....:	No.140 Chashi Road, Tangjiao Village, Chashan Town, Dongguan, China
Product Name.....:	**Wireless Earphones**
Trade Mark.....:	N/A
Model/Type reference.....:	K2
Listed Model(s).....:	N/A
Standard.....:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of Receipt.....:	Mar.11, 2020
Date of Test Date.....:	Mar.11, 2020-Mar.17, 2020
Date of issue.....:	Mar.17, 2020
Test result.....:	**Pass**

Compiled by: (Printed name+signature)	Emiya Lin	Emiya Lin
Supervised by: (Printed name+signature)	Kelly Cheng	Kelly Cheng
Approved by: (Printed name+signature)	Cary Luo	Cary Luo

KSIGN(Guangdong) Testing Co., Ltd. KSIGN APPROVED

Testing Laboratory Name.....:	**KSIGN(Guangdong) Testing Co., Ltd.**
Address.....:	First Floor West Side, Building C, Zone A,Fuyuan New Factory, Jiujiu Industrial Park, Minzhu Village, Shatou Community, Shajing Street, Bao'an District, Shenzhen City,Guangdong Province, P. R. China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Date of issue	Description
01	Mar.17, 2020	Original

1.3. Test Description

FCC Part 15 Subpart C(15.247)			
Test Item	Standard Section	Result	Test Engineer
	FCC		
Antenna Requirement	15.203	Pass	Emiya Lin
Conducted Emission	15.207	Pass	Emiya Lin
Restricted Bands	15.205	Pass	Emiya Lin
Hopping Channel Separation	15.247(a)(1)	Pass	Emiya Lin
Dwell Time	15.247(a)(1)	Pass	Emiya Lin
Peak Output Power	15.247(b)(1)	Pass	Emiya Lin
Number of Hopping Frequency	15.247(b)(1)	Pass	Emiya Lin
Band Edge Emissions	15.247(d)	Pass	Emiya Lin
Radiated Spurious Emission	15.247(c)&15.209	Pass	Emiya Lin
99% Occupied Bandwidth & 20dB Bandwidth	15.247(a)	Pass	Emiya Lin
Pseudorandom Frequency Hopping Sequence	15.247 (a)(1)	Pass	Emiya Lin

Note: The measurement uncertainty is included in the test result.

1.4. Test Facility

Address of the report laboratory

KSIGN(Guangdong) Testing Co., Ltd.

First Floor West Side, Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu Village, Shatou Community, Shajing Street, Bao'an District, Shenzhen City, Guangdong Province, P. R. China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Cert. No.: 5457.01
KSIGN(Guangdong) Testing Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: CN0096

The 3m alternate test site of KSIGN(Guangdong) Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: CN0096

FCC-Registration No.: CN1272

KSIGN(Guangdong) Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the KSIGN(Guangdong) Testing Co., Ltd. system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Below is the best measurement capability for KSIGN(Guangdong) Testing Co., Ltd.

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	2.80 dB	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Dongguan Gorsun Electronics Co.,Ltd
Address:	No.140 Chashi Road, Tangjiao Village, Chashan Town, Dongguan, China
Manufacturer:	Dongguan Gorsun Electronics Co.,Ltd
Address:	No.140 Chashi Road, Tangjiao Village, Chashan Town, Dongguan, China

2.2. General Description of EUT

Product Name:	Wireless Earphones
Marketing Name:	N/A
Model/Type reference:	K2
Listed Model(s):	N/A
Model Difference:	N/A
Power Source:	DC 5V output from the USB port
Power supply(Battery):	DC 3.7V 60mAh from Li-ion Battery
Hardware version:	K2_V7
Software version:	N/A
Bluetooth 5.0	
Modulation:	GFSK(DH5), π/4-DQPSK(2DH5)
Operation frequency:	2402MHz~2480MHz
Max Peak Output Power:	DH5：1.40dBm 2DH5：2.21dBm
Channel number:	79
Channel separation:	1MHz
Antenna type:	PCB Antenna
Antenna gain:	-0.58dBi
Note: Left earphone was tested	

2.3. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
00	**2402**
01	2403
⋮	⋮
38	2440
39	**2441**
40	2442
⋮	⋮
77	2479
78	**2480**

Note: The display in grey were the channel selected for testing.

Test mode

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

2.4. Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
1	Spectrum Analyzer	R&S	FSV40-N	101798	Apr.25, 2020
2	Vector Signal Generator	Agilent	N5182A	MY50142520	Apr.10, 2020
3	Analog Signal Generator	HP	83752A	3344A00337	Apr.10, 2020
4	Power Sensor	Agilent	E9304A	MY50390009	Apr.10, 2020
5	Power Sensor	Agilent	E9300A	MY41498315	Apr.10, 2020
6	Wideband Radio Communication Tester	R&S	CMU200	115297	Apr.10, 2020
7	Climate Chamber	Angul	AGNH80L	1903042120	Apr.10, 2020
8	Dual Output DC Power Supply	Agilent	E3646A	MY40009992	Apr.10, 2020
9	RF Control Unit	Tonscend	JS0806-2	/	Apr.10, 2020

Transmitter spurious emissions & Receiver spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESR	102525	Apr.10, 2020
2	High Pass Filter	Chengdu E-Microwave	OHF-3-18-S	0E01901038	Apr.15, 2020
3	High Pass Filter	Chengdu E-Microwave	OHF-6.5-18-S	0E01901039	Apr.15, 2020
4	Spectrum Analyzer	HP	8593E	3831U02087	Apr.10, 2020
5	Ultra-Broadband logarithmic period Antenna	Schwarzbeck	VULB 9163	01230	Apr.17, 2020
6	Loop Antenna	Beijin ZHINAN	ZN30900C	18050	Apr.17, 2020
7	Horn Antenna	R&S	Sep-60	69483	Apr.10, 2020
8	Spectrum Analyzer	R&S	FSV40-N	101798	Apr.25, 2020
9	Horn Antenna	Schwarzbeck	BBHA 9120 D	2023	Apr.10, 2020
10	Pre-Amplifier	Schwarzbeck	BBV 9745	9745#129	Apr.10, 2020
11	Pre-Amplifier	EMCI	EMC051835SE	980662	Apr.17, 2020
12	Power Meter	Agilent	E4419B	GB41293710	Apr.10, 2020

Note:
1)The Cal. Interval was one year.
2)The cable loss has calculated in test result which connection between each test instruments.

2.5. Test Software

Software name	Model	Version
Conducted emission Measurement Software	EZ-EMC	EMC-Con 3A1.1
Radiated emission Measurement Software	EZ-EMC	FA-03A.2.RE
Bluetooth and WIFI Test System	JS1120-3	2.5.77.0418

3. TEST ITEM AND RESULTS

3.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

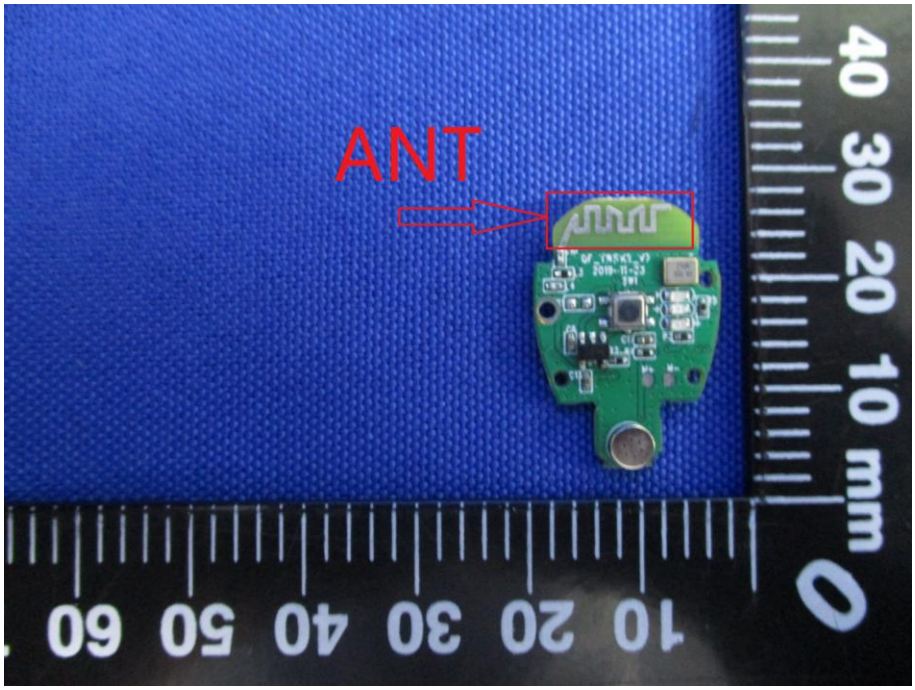
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.



3.2. Conducted Emission

Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

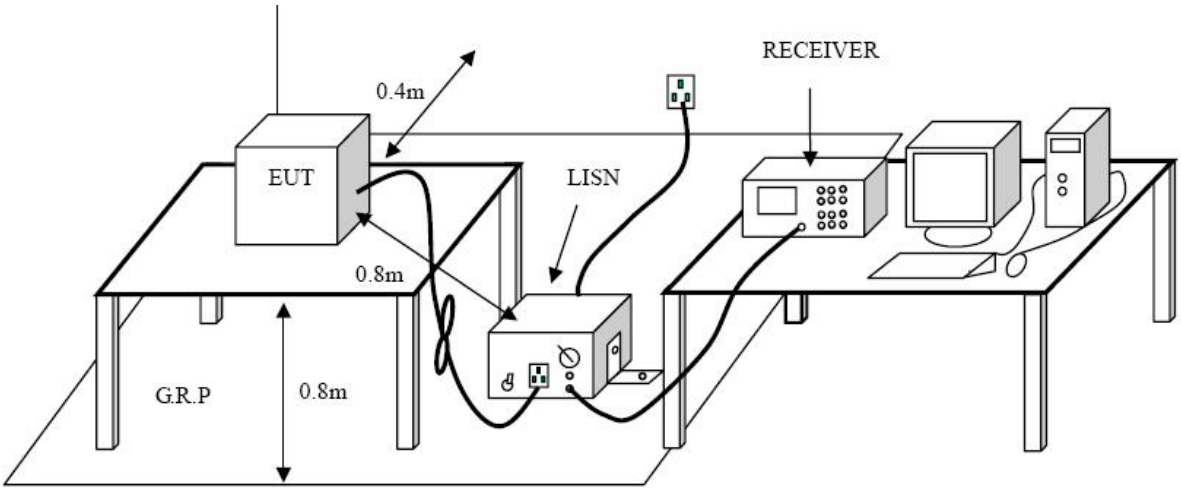
Notes:

(1) *Decreasing linearly with logarithm of the frequency.

(2) The lower limit shall apply at the transition frequencies.

(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Configuration



Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment.
   The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

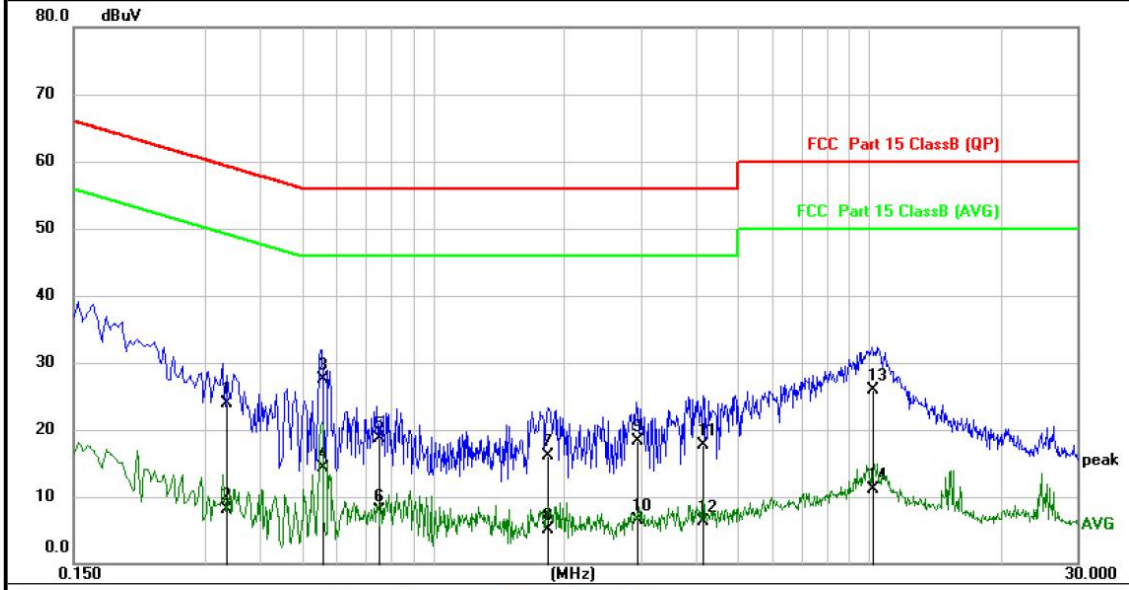
Test Mode:

Please refer to the clause

Test Results

Pre-scan DH5, 2DH5 modulation, and found the 2DH5 modulation 2402MHz which it is worse case, so only show the test data for worse case.

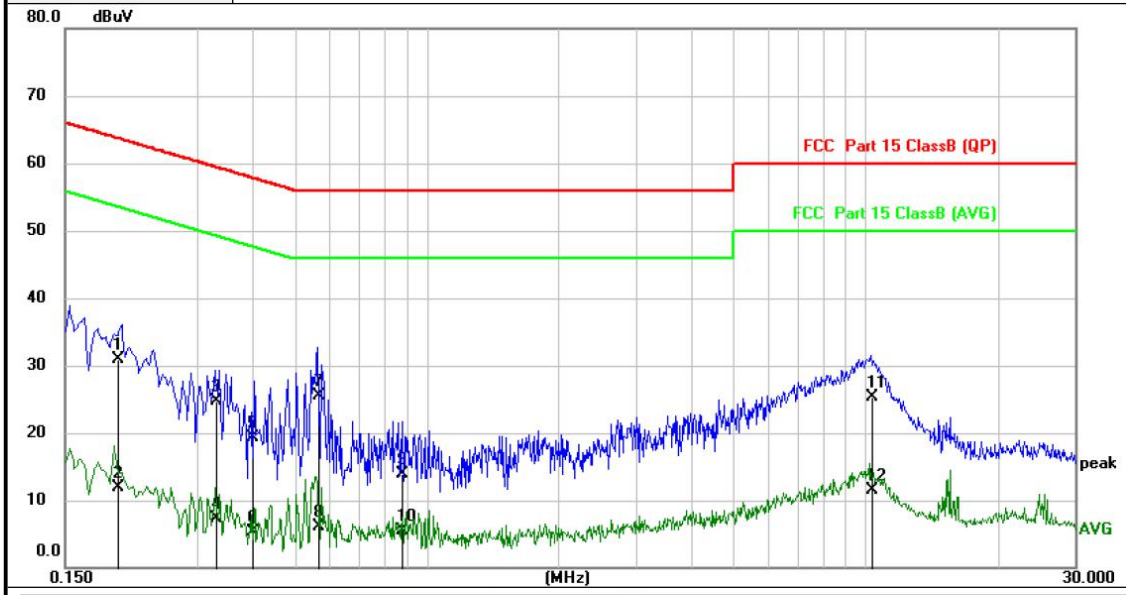
Test Voltage:	AC 120V/60 Hz
Terminal:	Line
Test Mode:	Charging+BT



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3356	14.14	9.71	23.85	59.31	-35.46	QP
2		0.3356	-1.64	9.71	8.07	49.31	-41.24	AVG
3	*	0.5608	17.82	9.75	27.57	56.00	-28.43	QP
4		0.5608	4.60	9.75	14.35	46.00	-31.65	AVG
5		0.7470	8.94	9.77	18.71	56.00	-37.29	QP
6		0.7470	-1.90	9.77	7.87	46.00	-38.13	AVG
7		1.8349	6.26	9.92	16.18	56.00	-39.82	QP
8		1.8349	-4.78	9.92	5.14	46.00	-40.86	AVG
9		2.9445	8.28	9.97	18.25	56.00	-37.75	QP
10		2.9445	-3.39	9.97	6.58	46.00	-39.42	AVG
11		4.1574	7.63	10.00	17.63	56.00	-38.37	QP
12		4.1574	-3.74	10.00	6.26	46.00	-39.74	AVG
13		10.1315	15.87	10.09	25.96	60.00	-34.04	QP
14		10.1315	1.03	10.09	11.12	50.00	-38.88	AVG

Remarks:
1.Measurement = Reading Level+ Correct Factor
2.Over = Measurement -Limit

Test Voltage:	AC 120V/60 Hz
Terminal:	Neutral
Test Mode:	Charging+BT



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1970	20.98	9.90	30.88	63.74	-32.86	QP
2		0.1970	1.96	9.90	11.86	53.74	-41.88	AVG
3		0.3305	14.93	9.70	24.63	59.44	-34.81	QP
4		0.3305	-2.30	9.70	7.40	49.44	-42.04	AVG
5		0.4012	9.52	9.71	19.23	57.83	-38.60	QP
6		0.4012	-4.43	9.71	5.28	47.83	-42.55	AVG
7	*	0.5667	15.77	9.75	25.52	56.00	-30.48	QP
8		0.5667	-3.68	9.75	6.07	46.00	-39.93	AVG
9		0.8791	4.15	9.80	13.95	56.00	-42.05	QP
10		0.8791	-4.29	9.80	5.51	46.00	-40.49	AVG
11		10.3142	15.39	9.99	25.38	60.00	-34.62	QP
12		10.3142	1.48	9.99	11.47	50.00	-38.53	AVG

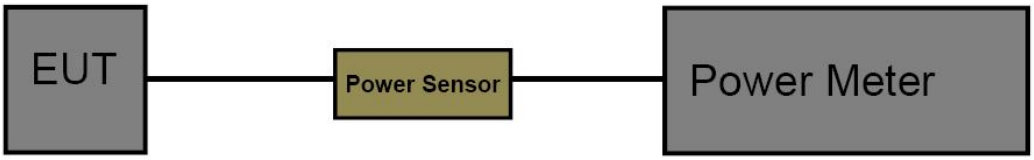
Remarks:
1.Measurement = Reading Level+ Correct Factor
2.Over = Measurement -Limit

3.3. Peak Output Power

Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

Test Configuration



Test Procedure

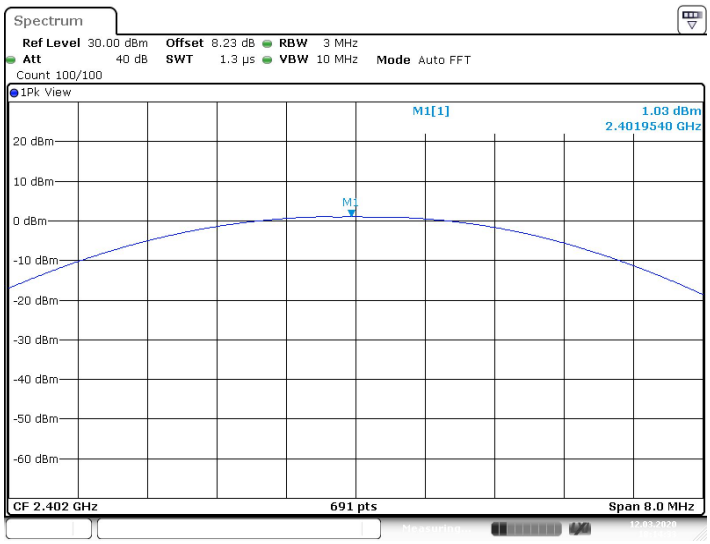
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.
   RBW=3 MHz, VBW=10 MHz for bandwidth more than 1MHz.

Test Mode

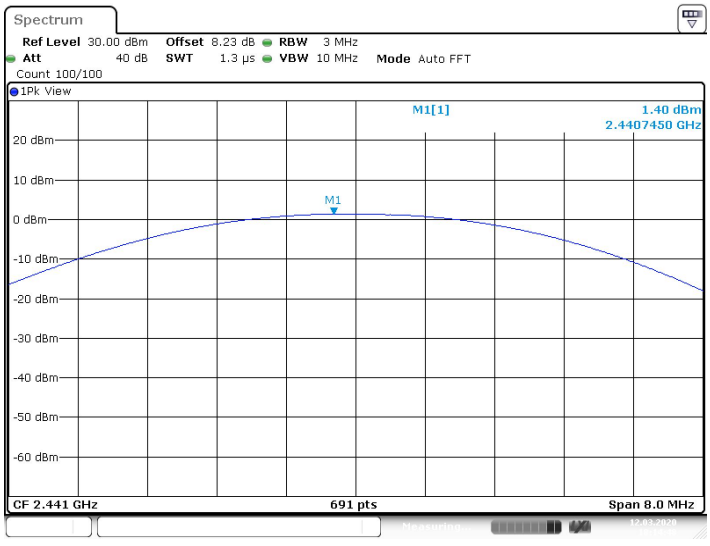
Please refer to the clause 2.3

Test Result

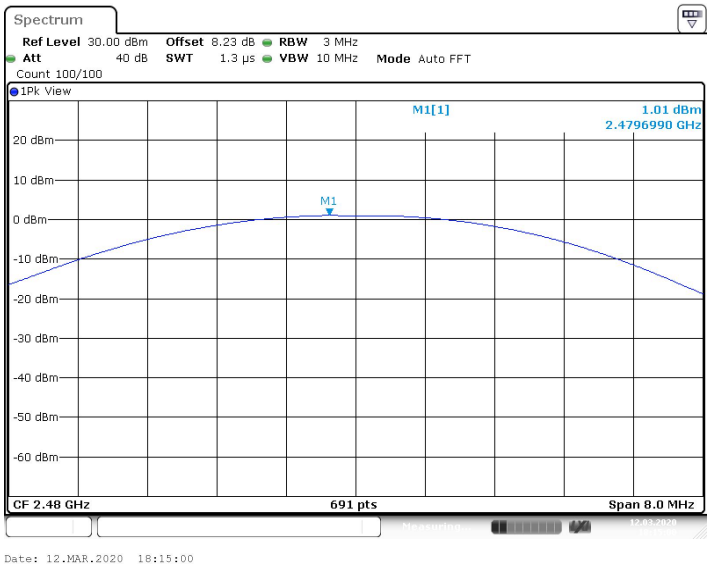
Test Mode:	DH5	
Channel frequency (MHz)	**Test Result (dBm)**	**Limit (dBm)**
2402	1.03	**30**
2441	1.40	
2480	1.01	
2402 MHz		



2441 MHz

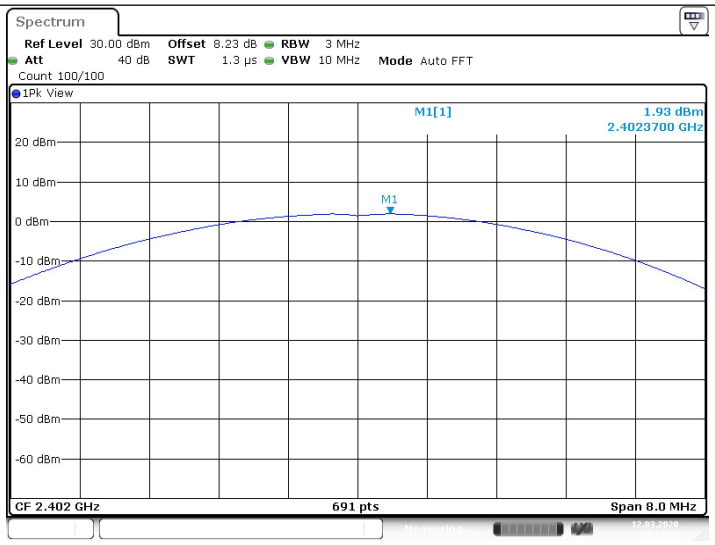


2480 MHz

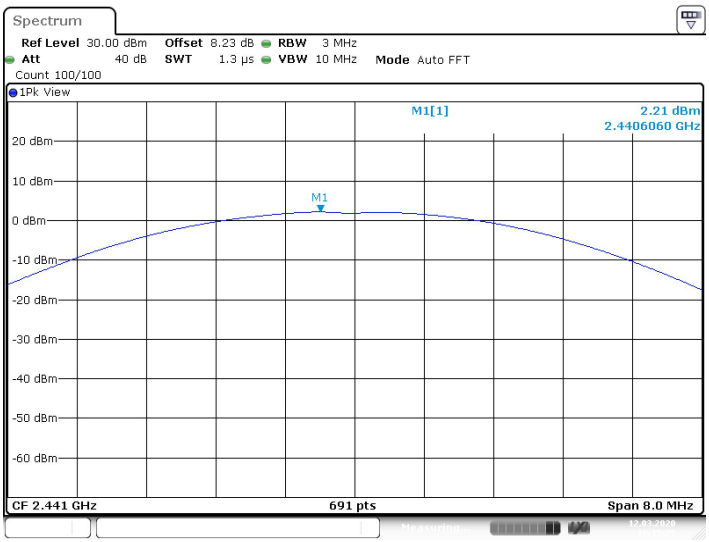

Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 3 MHz
Att 40 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 1.01 dBm
2.4796990 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
CF 2.48 GHz
691 pts
Span 8.0 MHz
Date: 12.MAR.2020 18:15:00

Test Mode:	2DH5	
Channel frequency (MHz)	**Test Result (dBm)**	**Limit (dBm)**
2402	1.93	**30**
2441	2.21	
2480	1.79	

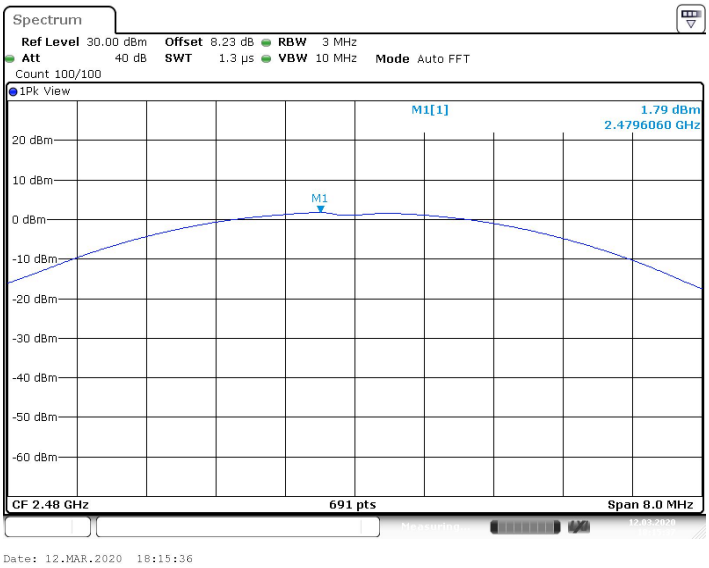
2402 MHz



2441 MHz



2480 MHz

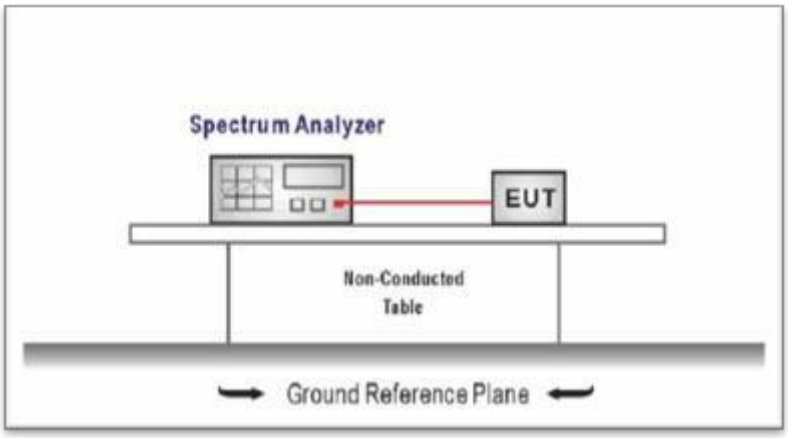

Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 3 MHz
Att 40 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 1.79 dBm
2.4796060 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
CF 2.48 GHz
691 pts
Span 8.0 MHz
Date: 12.MAR.2020 18:15:36

3.4. 99% Occupied Bandwidth & 20dB Bandwidth

Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:

   20dB Bandwidth
   (1) Set RBW = 30 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

   99% Occupied Bandwidth
   (1) Set RBW = 20 kHz.
   (2) Set the video bandwidth (VBW) =100 kHz.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

   NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

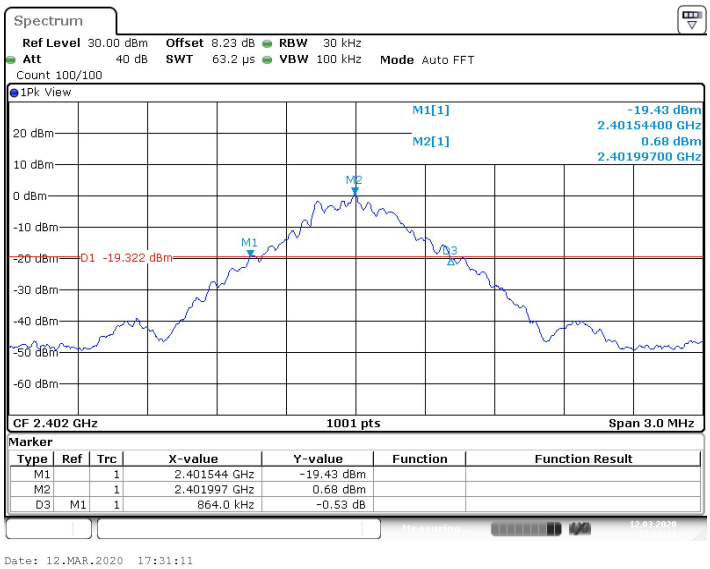
Test Mode

Please refer to the clause 2.3.

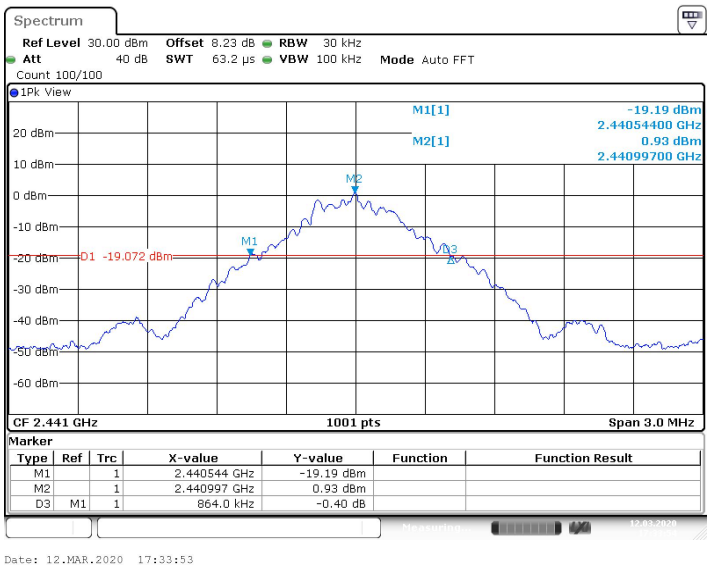
Test Results

Test Mode:	DH5			
Channel frequency (MHz)	20dB Bandwidth [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	0.864	2401.544	2402.408	PASS
2441	0.864	2440.544	2441.408	PASS
2480	0.864	2479.544	2480.408	PASS

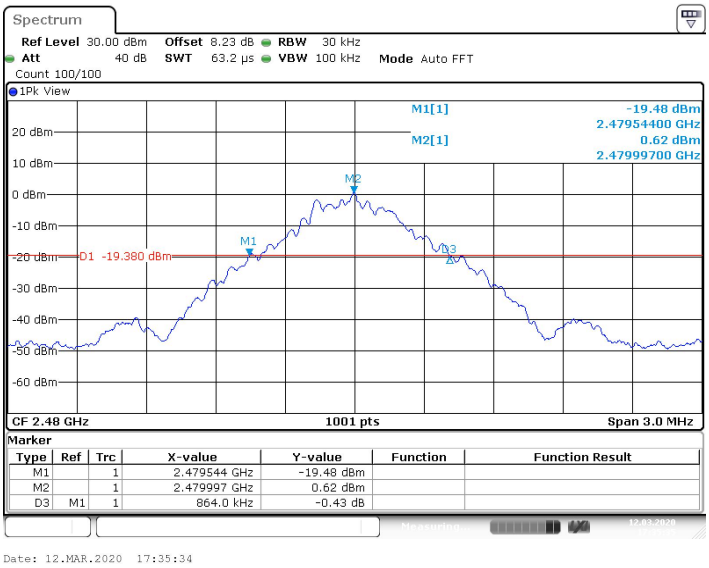
2402 MHz



2441 MHz

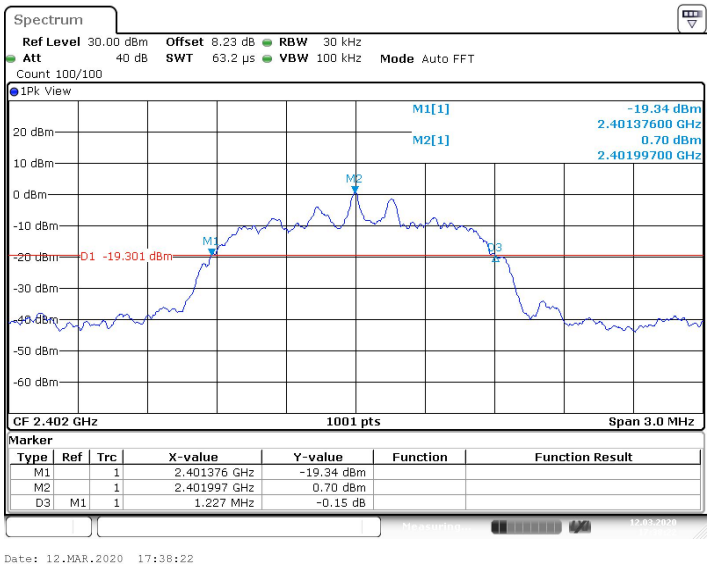


2480 MHz


Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 30 kHz
Att 40 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -19.48 dBm
2.47954400 GHz
M2[1] 0.62 dBm
2.47999700 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
D1 -19.380 dBm
M1
M2
D3
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479544 GHz -19.48 dBm
M2 1 2.479997 GHz 0.62 dBm
D3 M1 1 864.0 kHz -0.43 dB
Date: 12.MAR.2020 17:35:34

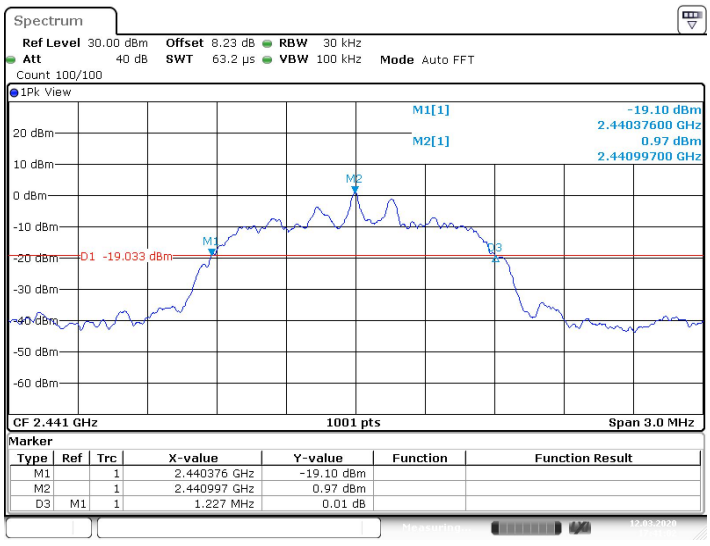
Test Mode:	2DH5			
Channel frequency (MHz)	20dB Bandwidth [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.227	2401.376	2402.603	PASS
2441	1.227	2440.376	2441.603	PASS
2480	1.230	2479.373	2480.603	PASS

2402 MHz



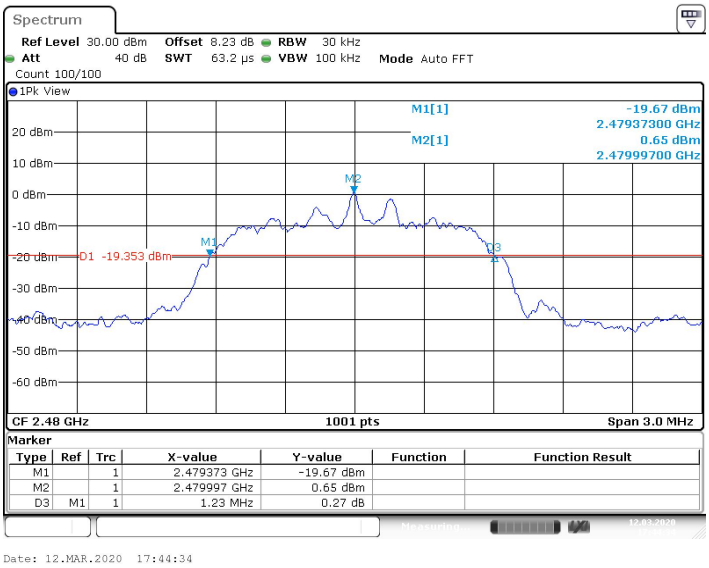
Date: 12.MAR.2020 17:38:22

2441 MHz



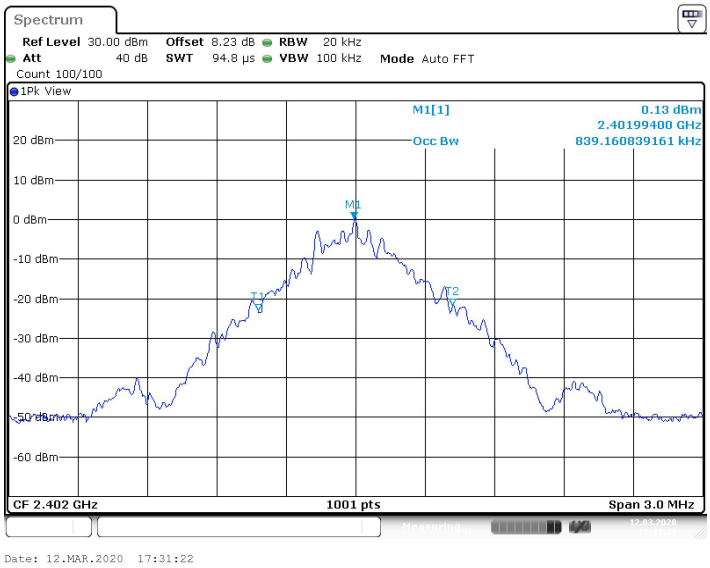
Date: 12.MAR.2020 17:41:02

2480 MHz

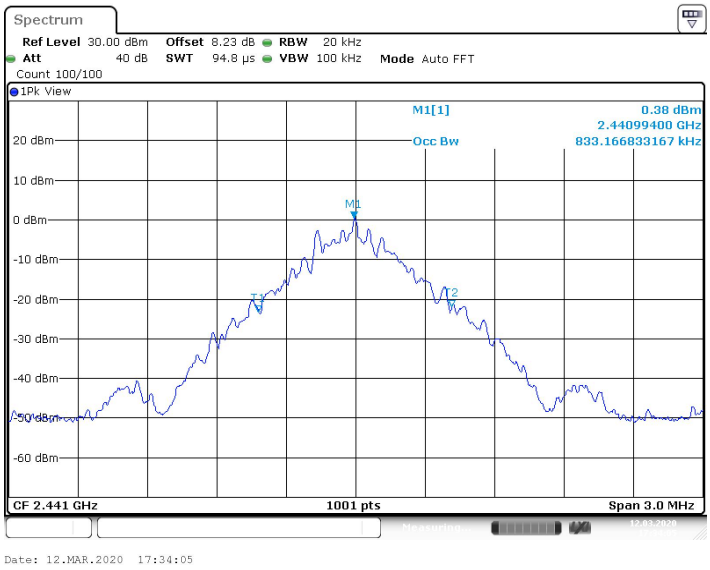

Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 30 kHz
Att 40 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -19.67 dBm
2.47937300 GHz
M2[1] 0.65 dBm
2.47999700 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
D1 -19.353 dBm
M1
M2
D3
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479373 GHz -19.67 dBm
M2 1 2.479997 GHz 0.65 dBm
D3 M1 1 1.23 MHz 0.27 dB
Date: 12.MAR.2020 17:44:34

Test Mode:	DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	0.839	2401.577	2402.417	PASS
2441	0.833	2440.580	2441.414	PASS
2480	0.839	2479.577	2480.417	PASS

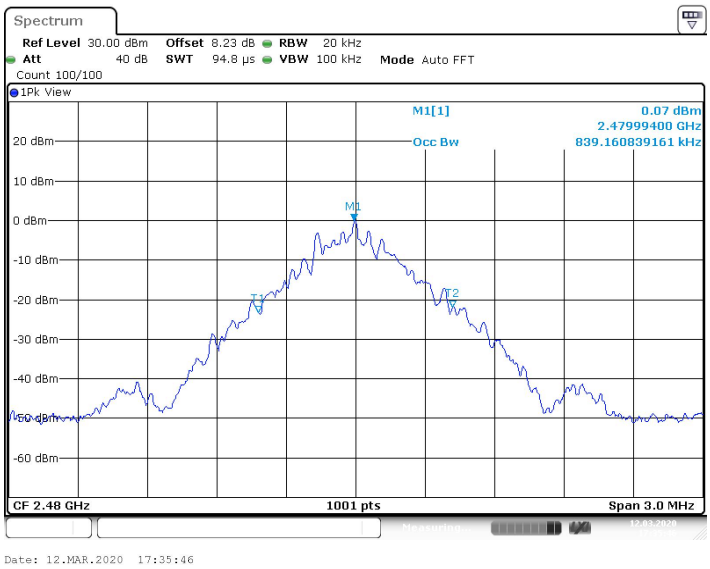
2402 MHz



2441 MHz

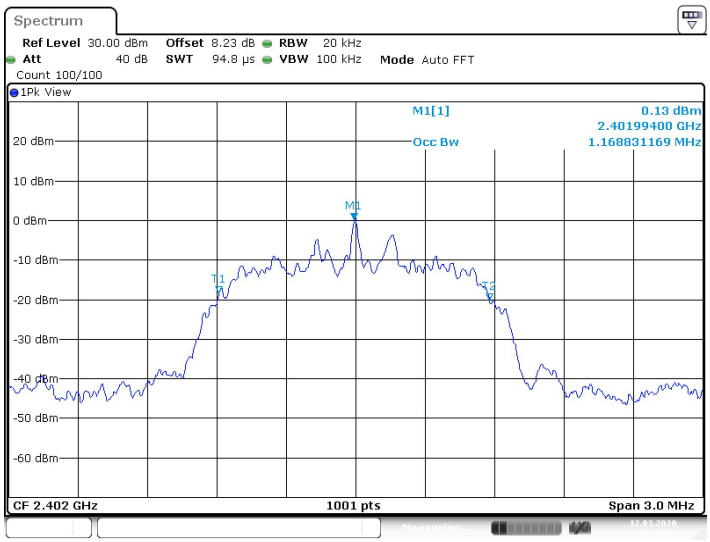


2480 MHz

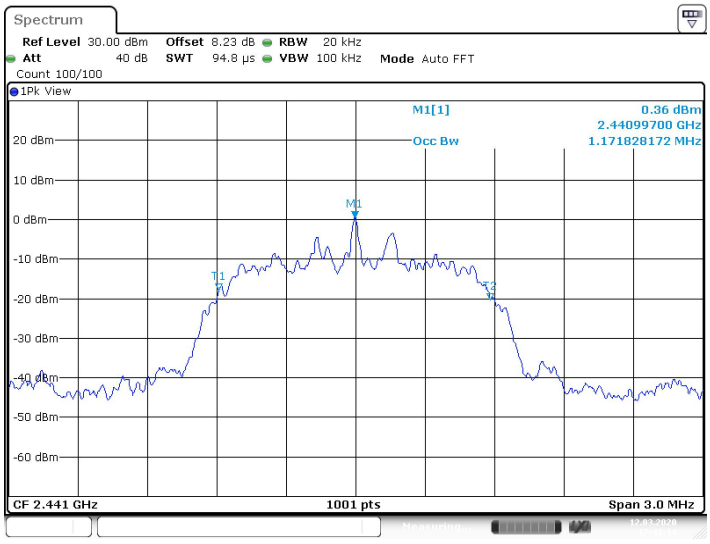

Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz
Att 40 dB SWT 94.8 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 0.07 dBm
2.47999400 GHz
Occ Bw 839.160839161 kHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
T1
T2
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Date: 12.MAR.2020 17:35:46

Test Mode:	2DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.169	2401.410	2402.578	PASS
2441	1.172	2440.410	2441.581	PASS
2480	1.172	2479.410	2480.581	PASS

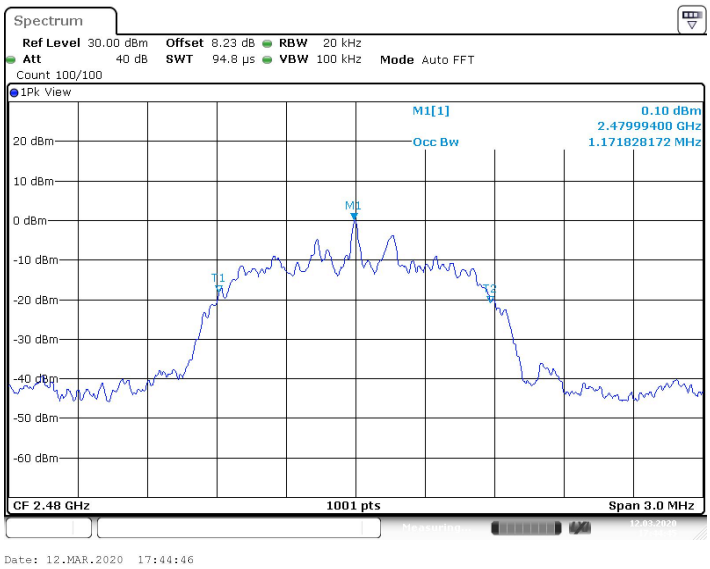
2402 MHz



2441 MHz



2480 MHz


Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz
Att 40 dB SWT 94.8 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 0.10 dBm
2.47999400 GHz
Occ Bw 1.171828172 MHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
T1
T2
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Date: 12.MAR.2020 17:44:46

3.5. Carrier Frequencies Separation

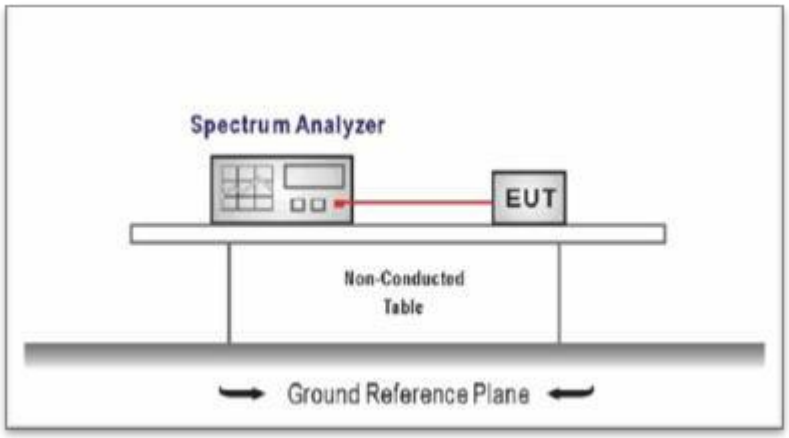
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, middle and high channel for the test, and found the middle channel which is the worse case, so only show the test date for worse case.

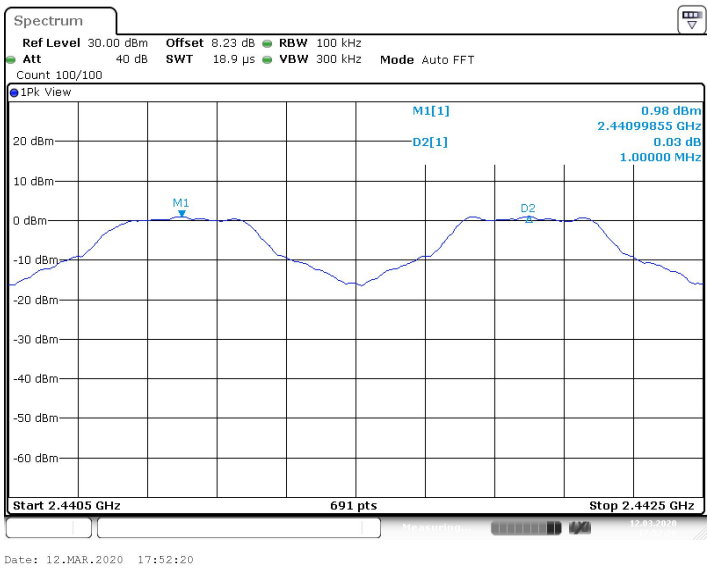
Test Mode

Please refer to the clause 2.3.

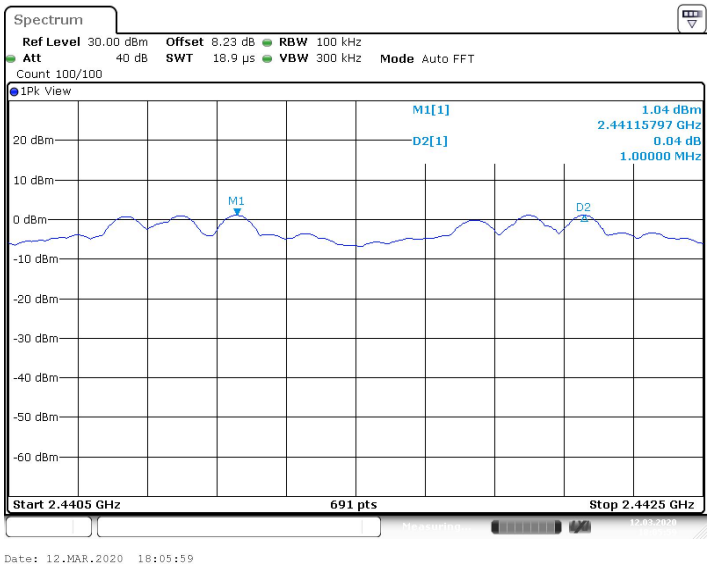
Test Results

Test Mode:	DH5 Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
DH5	1	>=0.576	PASS

DH5 Hopping Mode



Test Mode:	2DH5 Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
2DH5	1	>=0.818	PASS
2DH5 Hopping Mode			

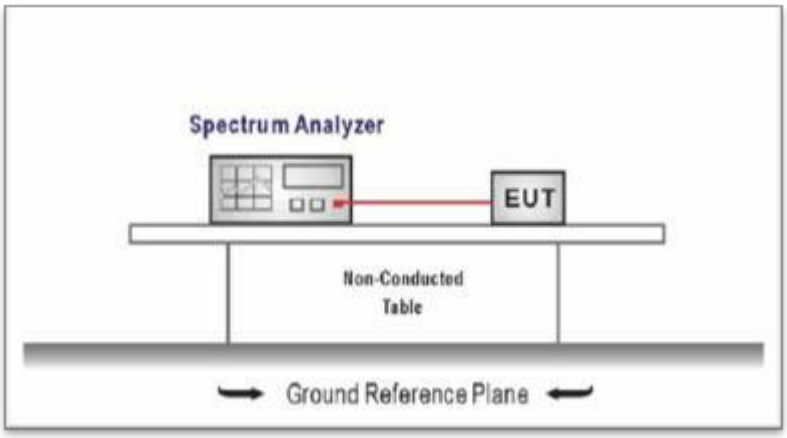


3.6. Number of Hopping Channel

Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

Test Configuration



Test Procedure

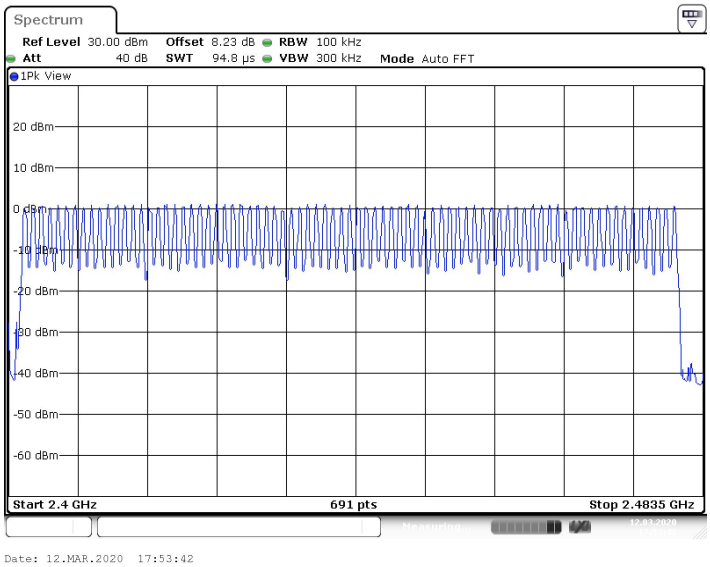
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW≥RBW, Sweep time= Auto.

Test Mode

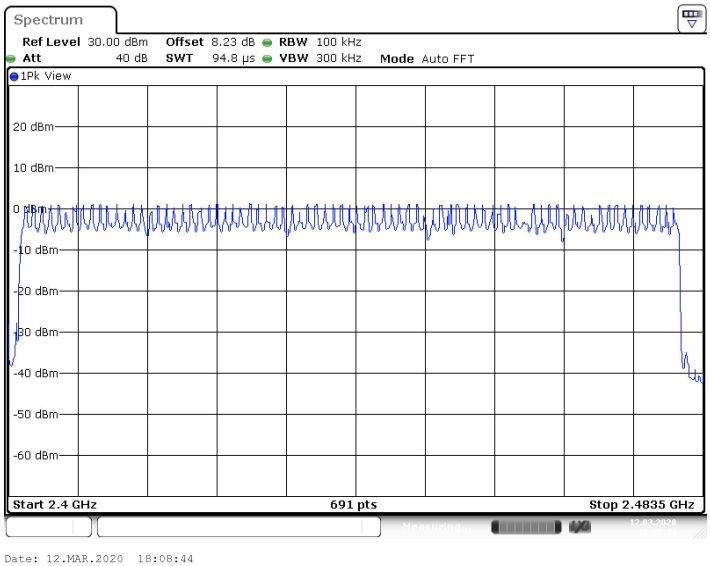
Please refer to the clause 2.3.

Test Result

Test Mode:	DH5 Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	DH5	79	**>15**
DH5 Mode			



Test Mode:	2DH5 Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	2DH5	79	**>15**
2DH5 Mode			

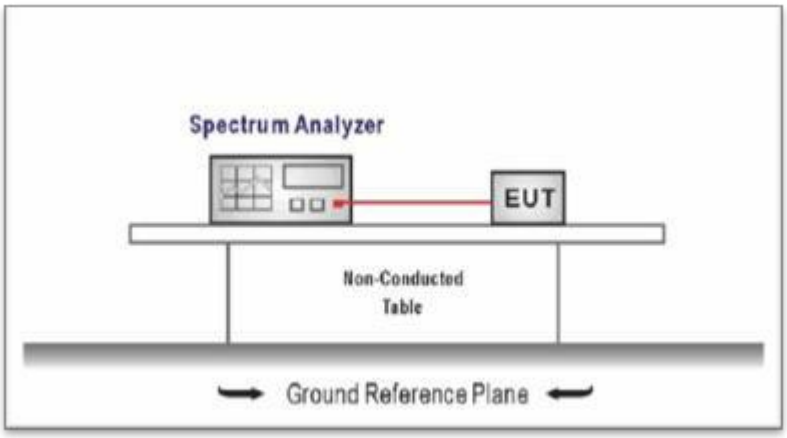


3.7. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(1)	Average Time of Occupancy	0.4 sec

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Spectrum Setting: RBW=1MHz, VBW≥RBW.
   (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
   (3) Sweep Time is more than once pulse time.
   (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
   (5) Measure the maximum time duration of one single pulse.
   (6) Set the EUT for packet transmitting.

Test Mode

Please refer to the clause 2.3

Test Result

Note:

1.We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.

2.Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2DH1, 3DH1

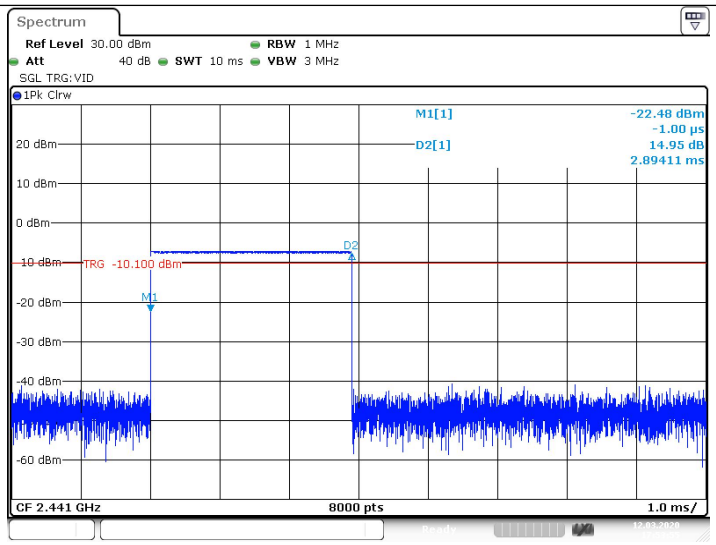
Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3

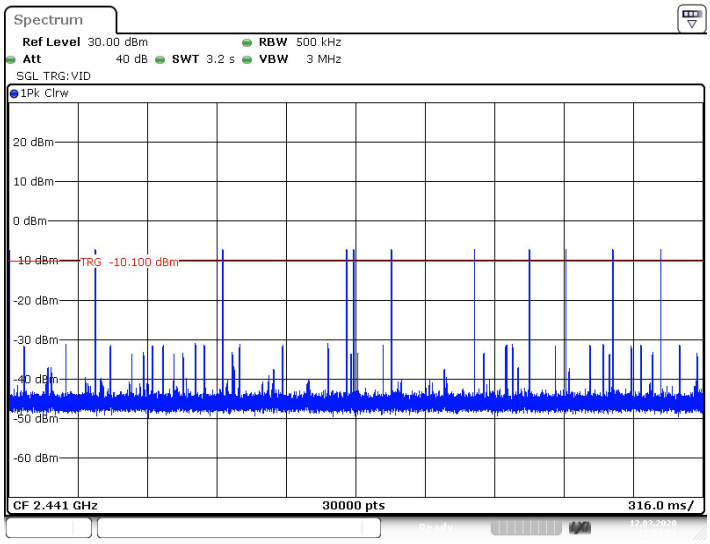
Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2DH5, 3DH5

Test Mode:	DH5 Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
DH5	2441	2.89	308.267	0.318	**400**	**PASS**
1DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						

DH5 Hopping Mode

2441 MHz



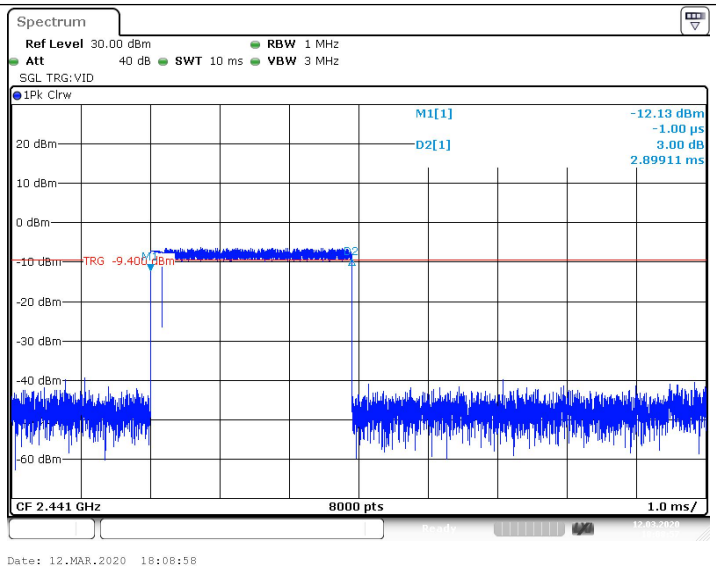


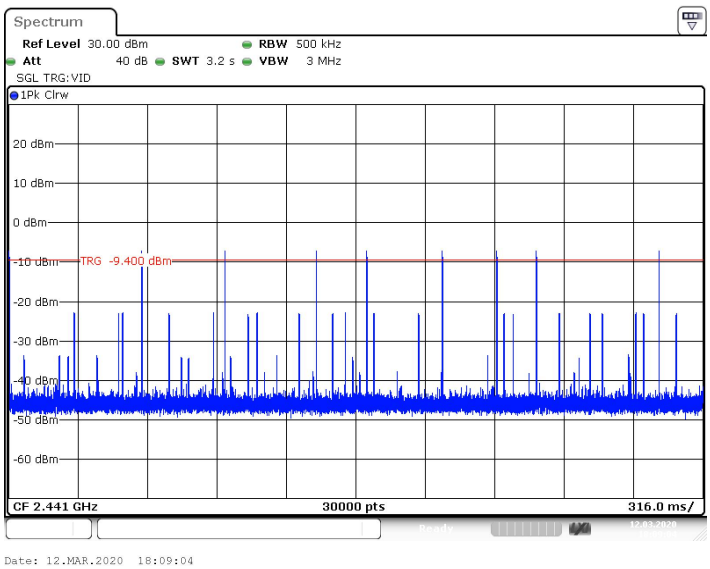
Test Mode:	2DH5 Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
2DH5	2441	2.90	309.333	0.261	**400**	**PASS**

2DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

2DH5 Hopping Mode

2441 MHz



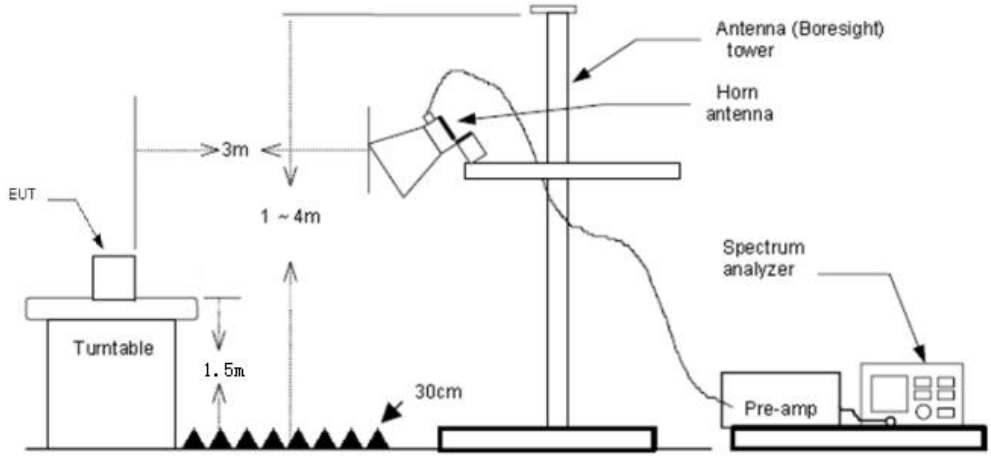


3.8. Band Edge Emissions(Radiated)

Limit

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
   RBW=1MHz, VBW=10Hz with Average Detector for Average Value.

Test Mode

Please refer to the clause 2.3.

Test Results

Note:

1.Measurement = Reading level + Correct Factor

Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

2.Pre-scan DH5, 2DH5 modulation, and found the 2DH5 modulation which it is worse case, so only show the test data for worse case.