FCC Part 15 Subpart B&C §15.247
RSS-247 Issue 2

Test Report

Equipment Under Test	**TWS Ear-phone**
Model Name	**ACCUID Button**
Variant Model Name	**-**
FCC ID	**2AWHT-ACCUIDBUTTON**
IC Number	**-**
Applicant	**ORFEO Soundworks Inc.**
Manufacturer	**ORFEO Soundworks Inc.**
Date of Test(s)	**2020. 05. 06 ~ 2020. 05. 21**
Date of Issue	**2020. 07. 01**

In the configuration tested, the EUT complied with the standards specified above.

Issue to	Issue by
ORFEO Soundworks Inc. 5th Floor, 36, Seolleung-ro 92-gil, Gangnam-gu, Seoul, South Korea Tel.: +82-70-8677-3378 Fax: +82-70-8677-3387	**MOVON CORPORATION** 498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17030 Tel.: +82-31-338-8837 Fax: +82-31-338-8847

Revision history

Revision	Date of issue	Description	Revised by
--	2020.06.29	Initial	-
1	2020.07.01	FCC ID Rivised	Suhyun Seo

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1. Applicant Information

1.1. Details of applicant

Applicant	:	ORFEO Soundworks Inc.
Address	:	5th Floor, 36, Seolleung-ro 92-gil, Gangnam-gu, Seoul, South Korea
Contact Person	:	Brian Jo
Telephone	:	+82-70-8677-3378
Fax	:	+82-70-8677-3387

1.2. Manufacturer Information

Manufacturer	:	ORFEO Soundworks Inc.
Address	:	5th Floor, 36, Seolleung-ro 92-gil, Gangnam-gu, Seoul, South Korea

2. Laboratory Information

Company name	:	MOVON CORPORATION
Test site number	:	FCC (KR0151), IC (24841)
FCC Address	:	498-2, Geumeo-ro, Pogok-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea
IC Address	:	7, Seolleung-ro 94-gil, Gangnam-gu, Seoul-si, Korea
Web site	:	http://www.movonlab.co.kr
Telephone	:	+82-31-338-8837
Facsimile		+82-31-338-8847

3. Summary of test results

The EUT has been tested according to the following specifications:

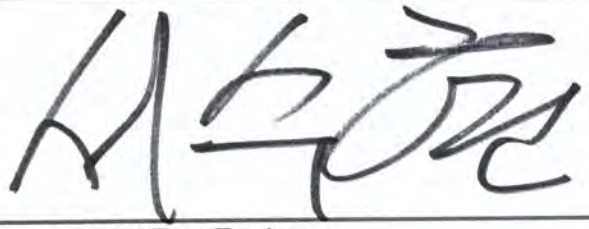
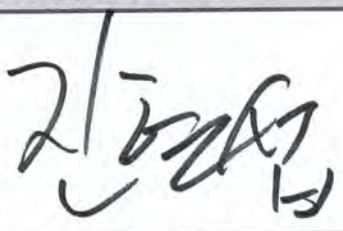
FCC Rule FCC part 15	IC Rule RSS-247, RSS-GEN	Description	Result
15.203 15.247(b)(4)	-	Antenna requirement	C
15.247(a)(1)	RSS-247 5.1(b) RSS-GEN 6.7	20 dB bandwidth & 99 % bandwidth	C
15.247(b)(1)	RSS-247 5.4(b)	Peak output power	C
15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	C
15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping frequency	C
15.247(a)(1)(iii)	RSS-247 5.1(d)	Time of occupancy (Dwell time)	C
15.205(a) 15.209(a) 15.247(d)	RSS-GEN 8.9 RSS-GEN 8.10 RSS-247 5.5	Transmitter radiated spurious emissions, Conducted spurious emission	C
15.207(a)	RSS-GEN 8.8	AC Conducted power line test	C

※ Abbreviation

C Complied
N/A Not applicable
F Fail

The sample was tested according to the following specification:
FCC Parts 15.247; ANSI C63.4:2014, ANSI C63.10:2013, FCC Public Notice DA 00-705
RSS-247 Issue 2, RSS-GEN Issue 5

Approval Signatories

Test and Report Completed by :	Report Approval by :
	
Suhyun Seo / Test Engineer MOVON CORPORATION	Issac Jin / Technical Manager MOVON CORPORATION

4. EUT Description

Kind of product	TWS Ear-phone
Model Name	ACCUID Button
Variant Model Name	-
FCC ID	2AWHT-ACCUIDBUTTON
IC Number	-
Power supply	DC 3.70 V
Frequency range	2 402 MHz ~ 2 480 MHz
Modulation technique	GFSK, Pi/4DQPSK, 8DPSK
Number of channels	79 ch
Antenna gain / Type	2.36 dBi / Chip Antenna
Test Site Registration Number	FCC (KR0151), IC (24841)
H/W version / S/W version	1.0 / 1.0
Test S/W version	3.2.3(Qualcomm BlueSuite)

4.1. Table for Test Modes and Frequency (Bluetooth)

Preliminary tests were performed in different data rate to find the worst radiated emission.
The data rate shown in the table below is the worst-case rate with respect to the specific test item.
Investigation has been done on all the possible configurations for searching the worst cases.
The following table is a list of the test modes shown in this test report.

Mode	Data rate (Worst case)	Frequency (Freq. MHz)
BDR	DH5	**Lowest** (2 402) / **Middle** (2 441) / **Highest** (2 480)
EDR	3-DH5	**Lowest** (2 402) / **Middle** (2 441) / **Highest** (2 480)

4.2. Information about the FHSS characteristics

4.2.1. Pseudorandom frequency hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1600 hops/s.

4.2.2. Medium access protocol

The manufacturer declares that the device uses Bluetooth protocol.
It confirmed that Medium access protocol is implemented.

5. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Calibration Interval	Calibration date	Calibration due.
Test Receiver	R&S	ESVS30	829673/015	1 year	2019-12-05	2020-12-05
Signal Generator	R&S	SMB100A	178128	1 year	2019-12-06	2020-12-06
Spectrum Analyzer	R&S	FSV-40	100832	1 year	2020-05-27	2021-05-27
DC Power Supply	Agilent	U8002A	MY56110033	1 year	2019-10-29	2020-10-29
Power Meter	Agilent	E4416A	GB41290645	1 year	2020-05-26	2021-05-26
Power Sensor	Agilent	9327A	US40441490	1 year	2020-05-26	2021-05-26
Horn Antenna	R&S	HF906	100236	2 year	2019-04-09	2021-04-09
Horn Antenna	AH Systems	SAS-572	269	1 year	2020-05-29	2021-05-29
Horn Antenna	AH Systems	SAS-573	164	1 year	2020-04-27	2021-04-27
Bi-Log Ant.	S/B	VULB 9161SE	4159	2 year	2020-03-30	2022-03-30
Loop Antenna	ETS LINDGREN	6502	00118166	2 year	2018-10-30	2020-10-30
Power Amplifier	TESTEK	TK-PA18H	170013-L	1 year	2021-05-26	2022-05-26
Power Amplifier	MITEQ	AFS43-01002600	2048519	1 year	2019-10-29	2020-10-29
Power Amplifier	MITEQ	AMF-6F-26004000-33-8P-HS	1511665	1 year	2019-12-09	2020-12-09
Step Attenuator	Agilent	8494B	US37181955	1 year	2020-05-27	2021-05-27
Controller	INNCO	CO2000	CO2000/064/6961003/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4000	MA4000/038/6961003/L	N/A	N/A	N/A
Controller	INNCO	CO3000	CO3000/812/34240914/L	N/A	N/A	N/A
Antenna Master	INNCO	MA4640-XP-ET	None	N/A	N/A	N/A
RF Cable	SUHNER	SUCOFLEX100	84047746	3 month	2020-06-05	2020-09-05
RF Cable	SUHNER	SUCOFLEX102	801270/2	3 month	2020-06-05	2020-09-05
RF Cable	SUHNER	SUCOFLEX102	801532/2	3 month	2020-06-05	2020-09-05
Band Rejection Filter	Micro-Tonics	BRM50702	064	1 year	2020-05-27	2021-05-27
Test Receiver	R&S	ESR3	101873	1 year	2020-05-26	2021-05-26
Pulse Limiter	R&S	ESH3-Z2	100288	1 year	2020-05-26	2021-05-26
Two Line-V-Network	R&S	ESH3-Z5	100296	1 year	2019-12-05	2020-12-06
Power Divider	HP	11636B	12481	1 year	2020-05-27	2021-05-27

※Remark
Support equipment

Description	Manufacturer	Model	Serial number
Notebook computer	DELL	Lattitude D510	-

6. Antenna requirement

6.1. Standard applicable

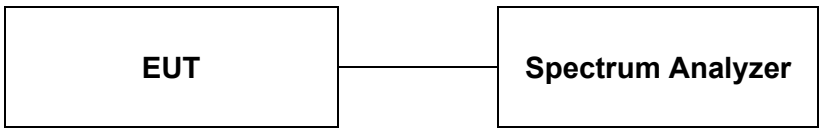
For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247 (c) if transmitting antennas of directional gain greater than 6dBi are used.

6.2. Antenna connected construction

Antenna used in this product is Chip antenna,
Antenna gain is 2.36 dBi.

7. 20 dB bandwidth & 99% bandwidth

7.1. Test setup



7.2. Limit

Not applicable

7.3. Test procedure

1. The 20 dB band width was measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20 dBband width of the emission was determined.
2. Set the spectrum analyzer as Span = approximately 2 to 3 times the 20 dB bandwidth, RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

7.4. Test results

Measurement data : refer to the next page

Test mode : BDR_Left

Frequency(㎒)	20 ㏈ bandwidth(㎒)	99% bandwidth(㎒)
2 402	0.76	0.87
2 441	0.76	0.87
2 480	0.76	0.87

Test mode : EDR_Left

Frequency(㎒)	20 ㏈ bandwidth(㎒)	99% bandwidth(㎒)
2 402	1.27	1.33
2 441	1.27	1.35
2 480	1.27	1.36

Test mode : BDR_Right

Frequency(㎒)	20 ㏈ bandwidth(㎒)	99% bandwidth(㎒)
2 402	0.76	0.87
2 441	0.76	0.87
2 480	0.76	0.86

Test mode : EDR_Right

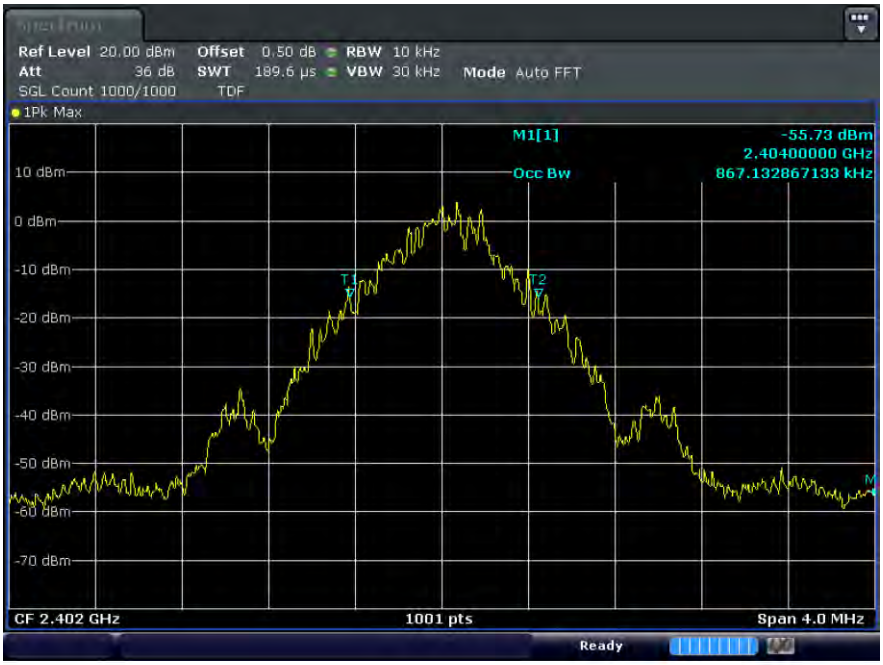
Frequency(㎒)	20 ㏈ bandwidth(㎒)	99% bandwidth(㎒)
2 402	1.27	1.32
2 441	1.27	1.32
2 480	1.27	1.34

7.4.1. Test plot

Test mode : BDR_Left

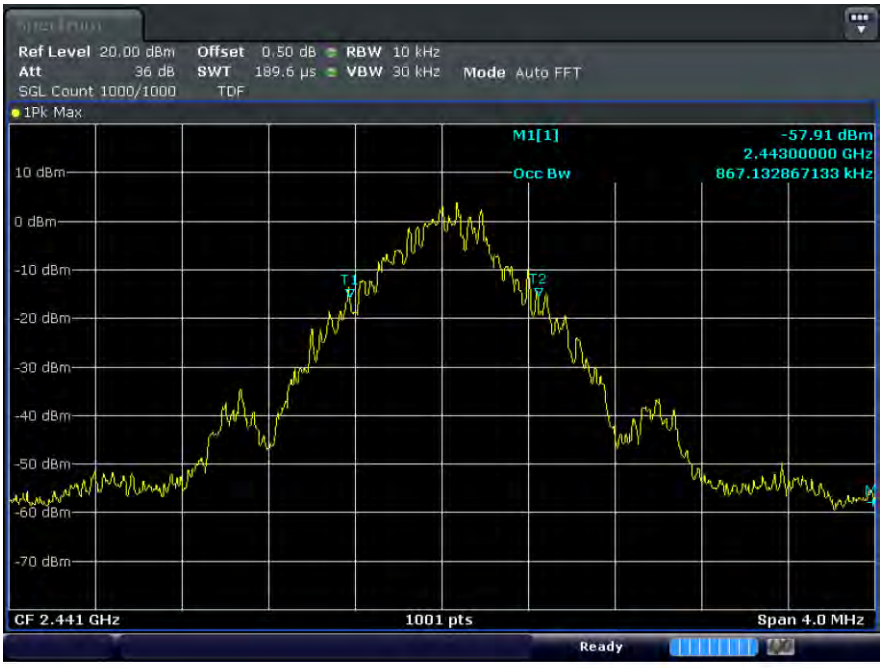
A.1. Lowest Ch. (2 402 MHz)_20 dB Bandwidth

A.2. Lowest Ch. (2 402 MHz)_99% Bandwidth



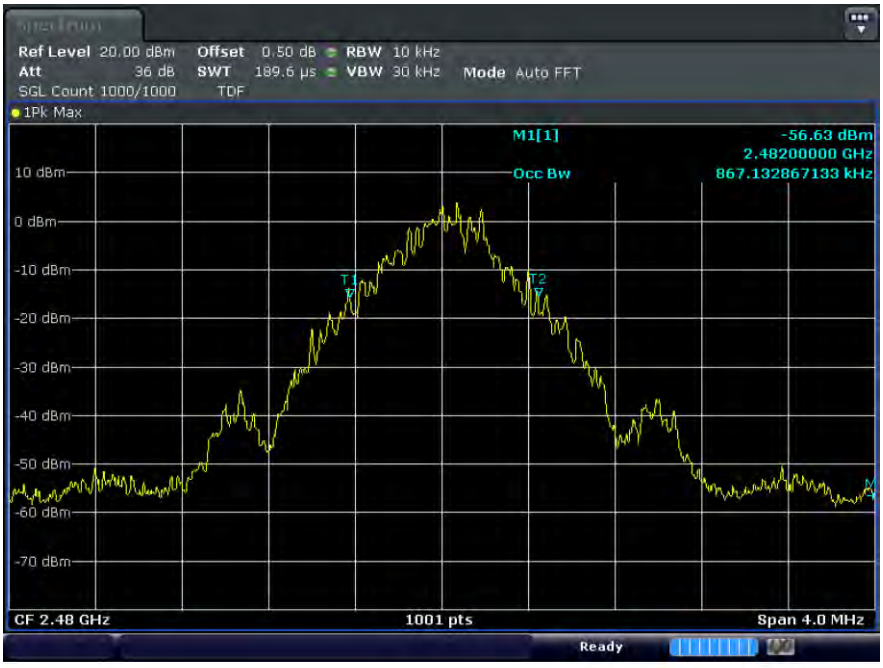
B.1. Middle Ch. (2 441 MHz)_20 dB Bandwidth

B.2. Middle Ch. (2 441 MHz)_99% Bandwidth



C.1. Highest Ch. (2 480 MHz)_20 dB Bandwidth

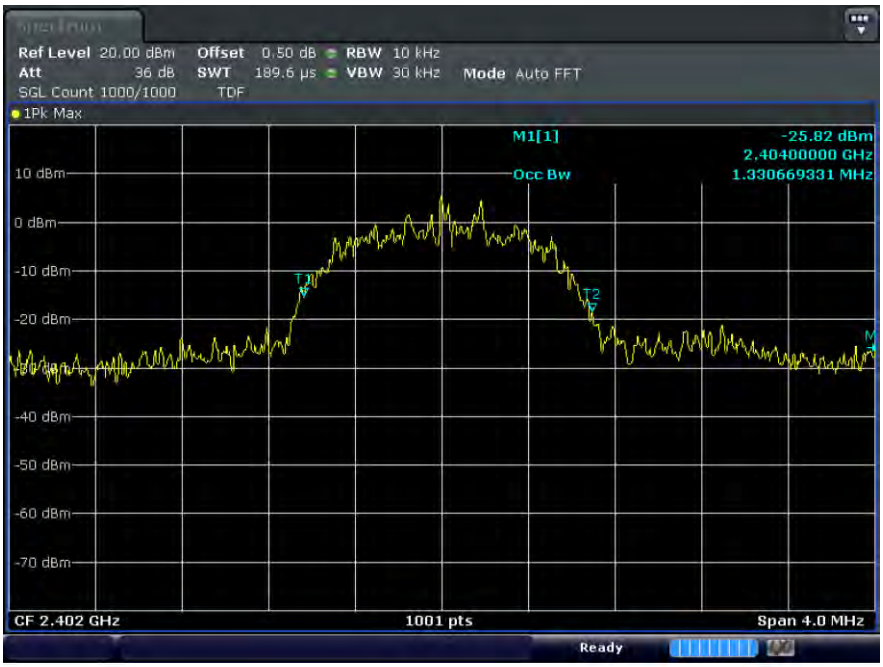
C.2. Highest Ch. (2 480 MHz)_99% Bandwidth



Test mode : EDR_Left

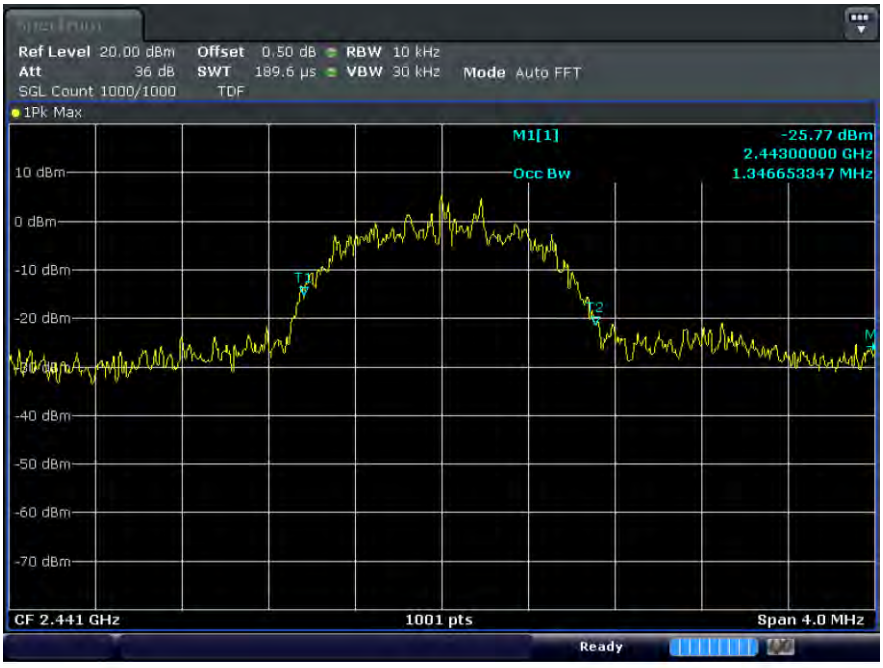
A.1. Lowest Ch. (2 402 MHz)_20 dB Bandwidth

A.2. Lowest Ch. (2 402 MHz)_99% Bandwidth



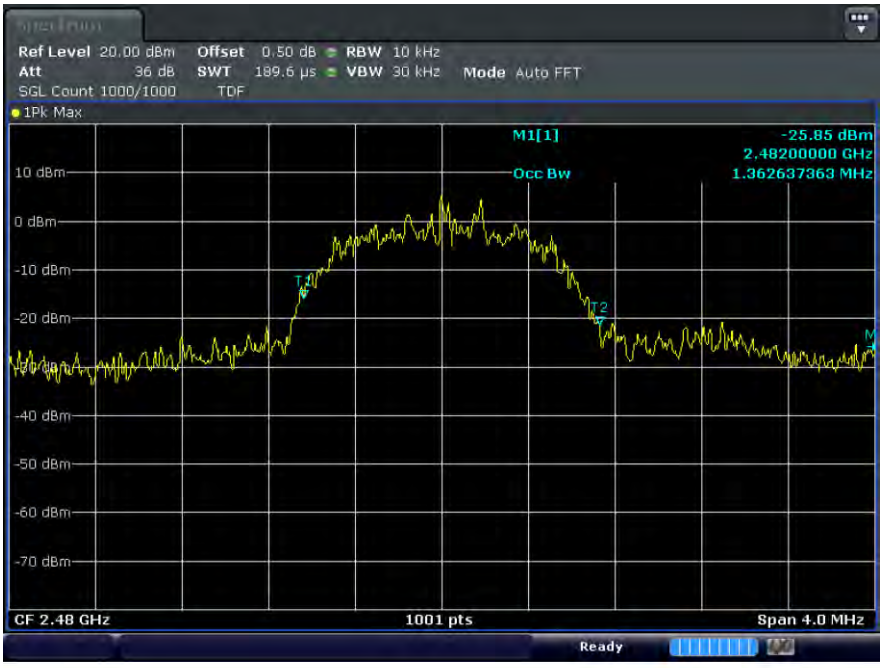
B.1. Middle Ch. (2 441 MHz)_20 dB Bandwidth

B.2. Middle Ch. (2 441 MHz)_99% Bandwidth



C.1. Highest Ch. (2 480 MHz)_20 dB Bandwidth

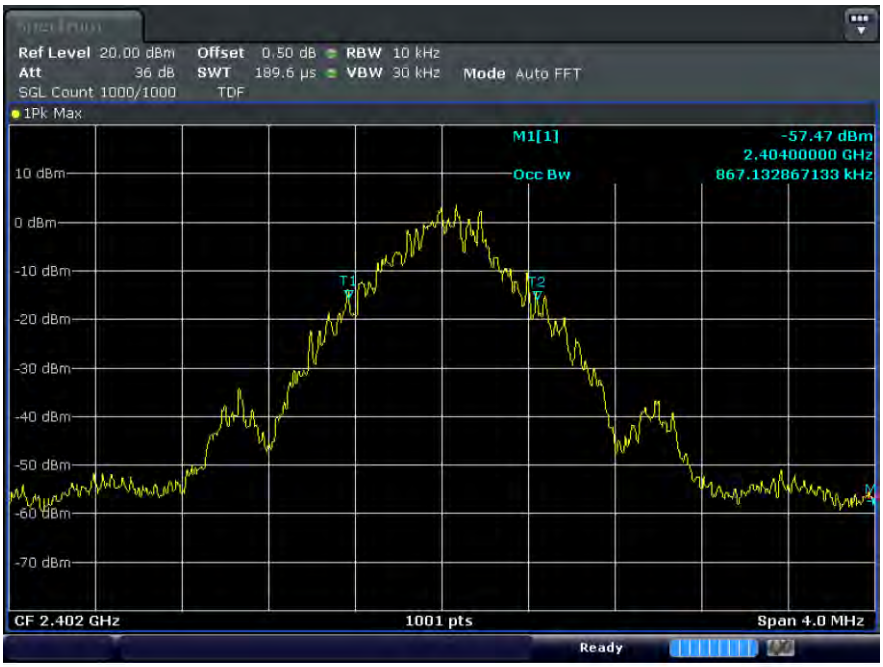
C.2. Highest Ch. (2 480 MHz)_99% Bandwidth



Test mode : BDR_Right

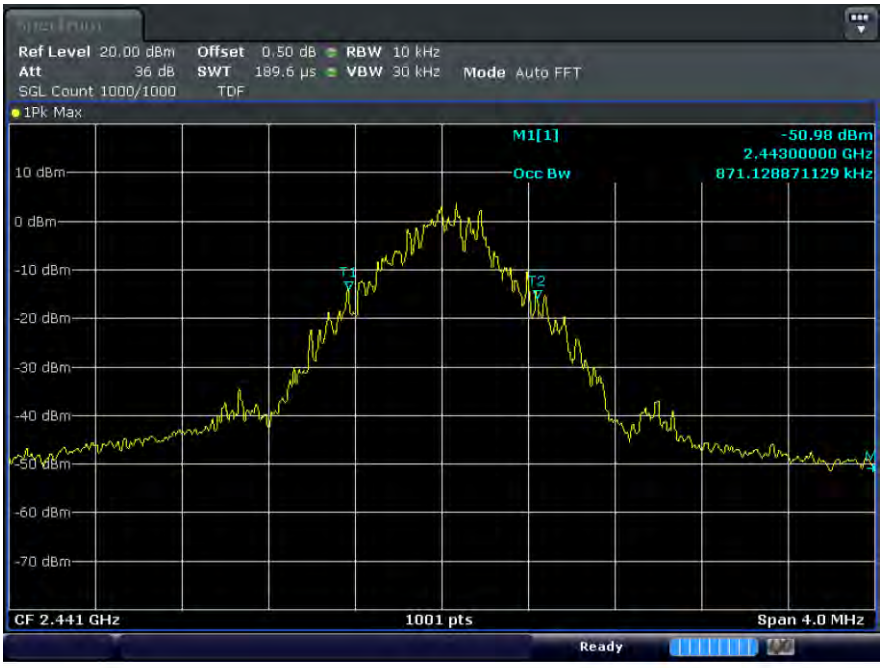
A.1. Lowest Ch. (2 402 MHz)_20 dB Bandwidth

A.2. Lowest Ch. (2 402 MHz)_99% Bandwidth



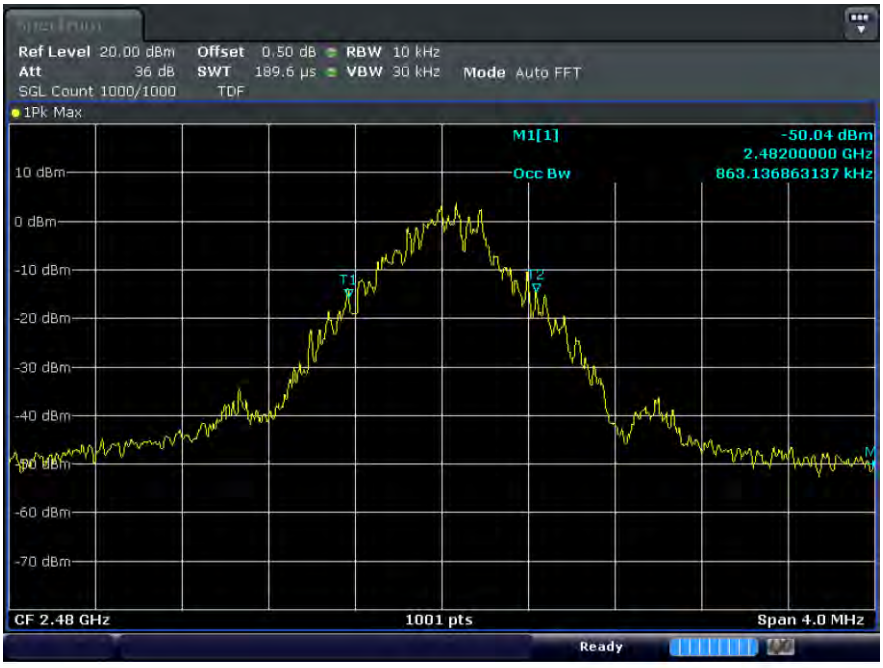
B.1. Middle Ch. (2 441 MHz)_20 dB Bandwidth

B.2. Middle Ch. (2 441 MHz)_99% Bandwidth



C.1. Highest Ch. (2 480 MHz)_20 dB Bandwidth

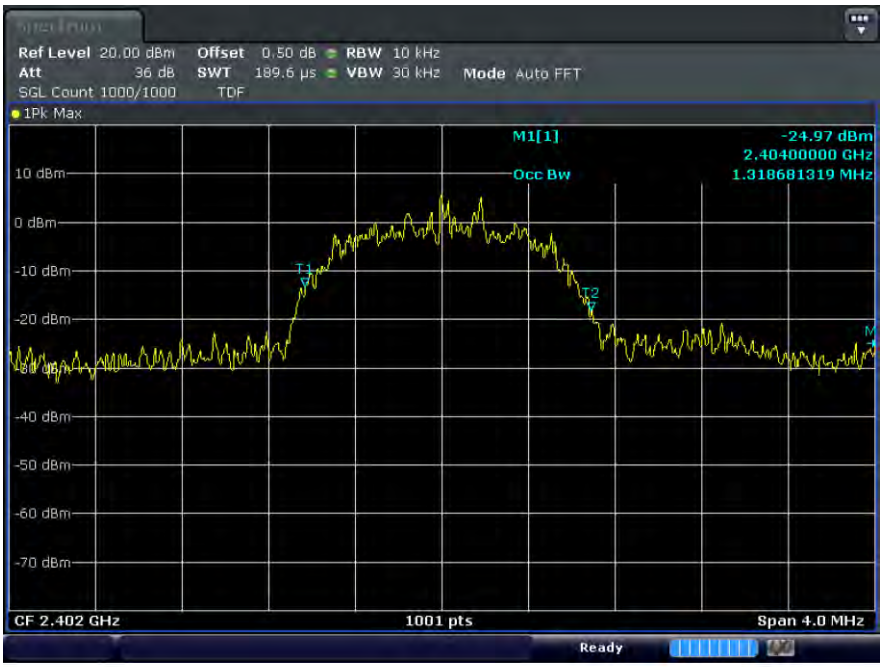
C.2. Highest Ch. (2 480 MHz)_99% Bandwidth



Test mode : EDR_Right

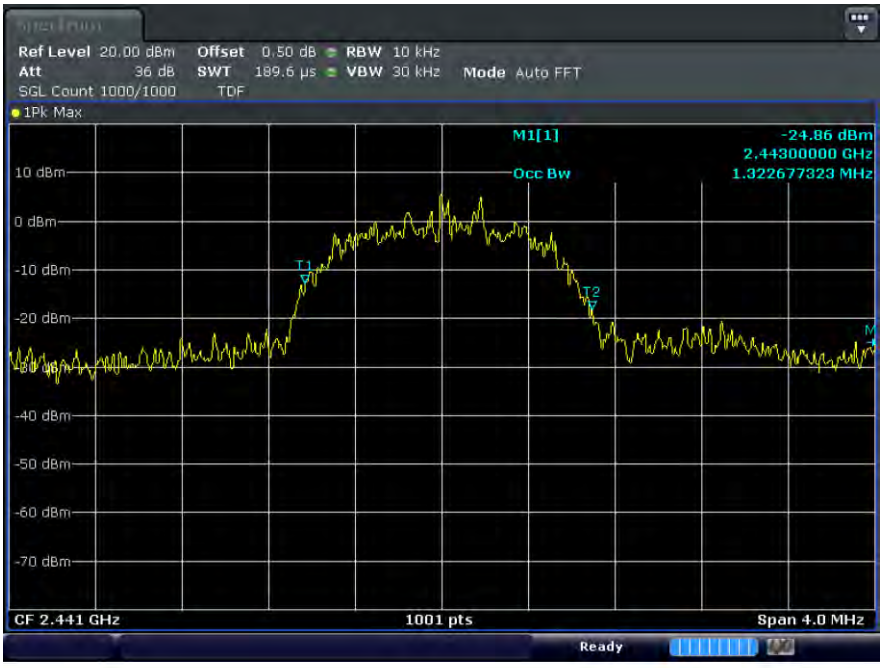
A.1. Lowest Ch. (2 402 MHz)_20 dB Bandwidth

A.2. Lowest Ch. (2 402 MHz)_99% Bandwidth



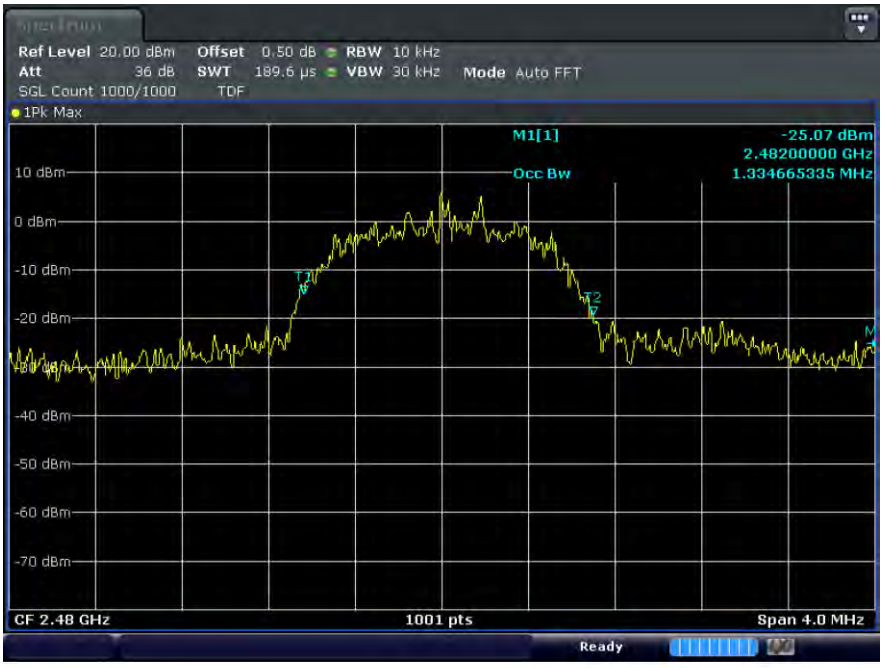
B.1. Middle Ch. (2 441 MHz)_20 dB Bandwidth

B.2. Middle Ch. (2 441 MHz)_99% Bandwidth



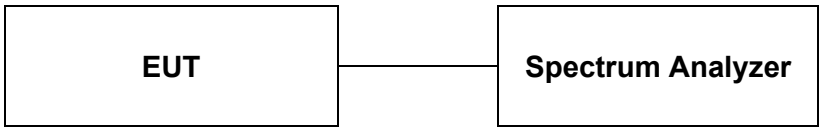
C.1. Highest Ch. (2 480 MHz)_20 dB Bandwidth

C.2. Highest Ch. (2 480 MHz)_99% Bandwidth



8. Peak output power

8.1. Test setup



8.2. Limit

The maximum peak output power of the intentional radiator shall not exceed the following:

1. §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 ㎑ or the 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽
2. §15.247(b)(1), For frequency hopping systems operating in the 2400–2483.5 ㎒ employing at least 75non-overlapping hopping channels, and all frequency hopping systems in the 5725–5805 ㎒ band: 1Watt.

8.3. Test procedure

1. The RF power output was measured with a Spectrum analyzer connected to the RF Antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
2. Set the spectrum analyzer as Span = approximately 5 times the 20 dB bandwidth, RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

8.4. Test results

Measurement data : refer to the next page

Test mode : BDR_Left

Frequency(㎒)	Peak output power (dBm)	Limit (dBm)
2 402	9.50	30.00
2 441	9.47	
2 480	9.39	

Test mode : EDR_Left

Frequency(㎒)	Peak output power (dBm)	Limit (dBm)
2 402	9.26	20.97
2 441	9.13	
2 480	9.31	

Test mode : BDR_Right

Frequency(㎒)	Peak output power (dBm)	Limit (dBm)
2 402	9.30	30.00
2 441	9.34	
2 480	9.35	

Test mode : EDR_Right

Frequency(㎒)	Peak output power (dBm)	Limit (dBm)
2 402	9.26	20.97
2 441	9.30	
2 480	9.44	

8.4.1. Test plot

Test mode : BDR_Left

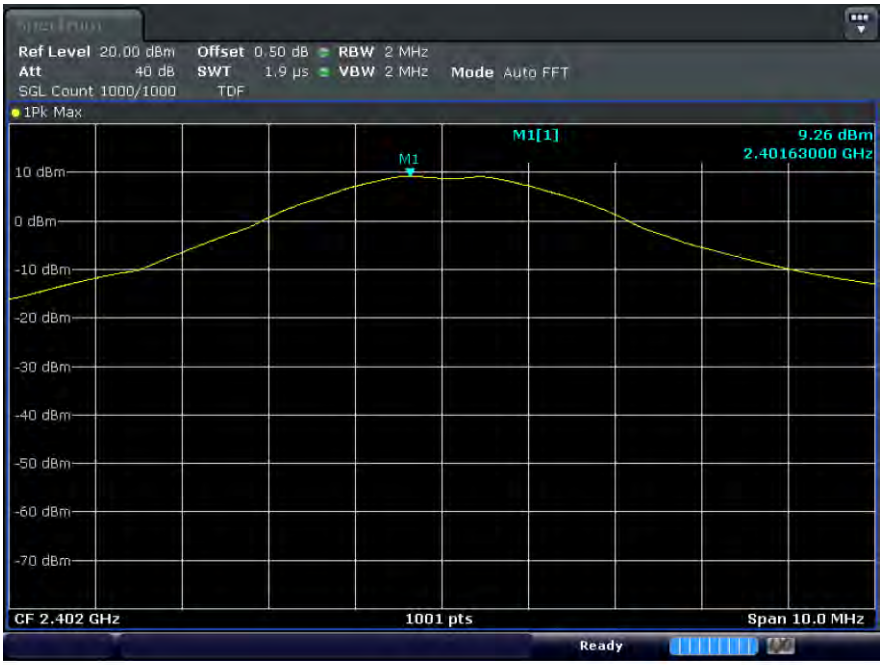
A. Lowest Ch. (2 402 MHz)

B. Middle Ch. (2 441 MHz)

C. Highest Ch. (2 480 MHz)

Test mode : EDR_Left

A. Lowest Ch. (2 402 MHz)



B. Middle Ch. (2 441 MHz)

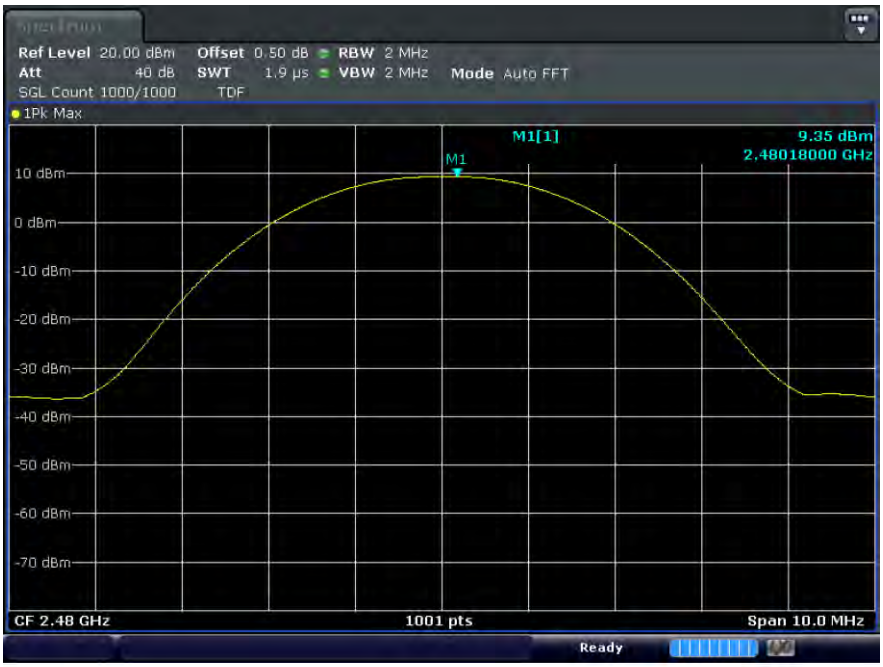
C. Highest Ch. (2 480 MHz)

Test mode : BDR_Right

A. Lowest Ch. (2 402 MHz)

B. Middle Ch. (2 441 MHz)

C. Highest Ch. (2 480 MHz)



Test mode : EDR_Right

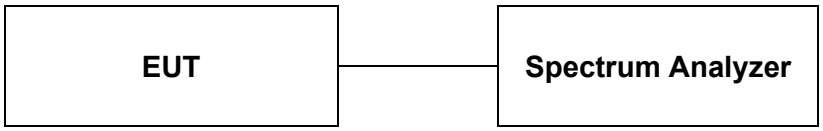
A. Lowest Ch. (2 402 MHz)

B. Middle Ch. (2 441 MHz)

C. Highest Ch. (2 480 MHz)

9. Carrier frequency separation

9.1. Test setup



9.2. Limit

§15.247(a)(1) Frequency hopping system operating in 2 400 – 2 483.5 ㎒. Band may have hopping channel carrier frequencies that are separated by 25 ㎑ or two-third of 20 ㏈ bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 ㎽.

9.3. Test procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the max hold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer mark function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.
6. Set center frequency of spectrum analyzer = middle of hopping channel.
7. Set the spectrum analyzer as Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

9.4. Test results

Measurement data : refer to the next page

Test mode : BDR_Left

Frequency (㎒)	Adjacent hopping Channel separation (㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
2 441	999.00	509.00	25.00

Test mode : EDR_Left

Frequency (㎒)	Adjacent hopping Channel separation (㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
2 441	999.00	847.00	25.00

Test mode : BDR_Right

Frequency (㎒)	Adjacent hopping Channel separation (㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
2 441	999.00	506.00	25.00

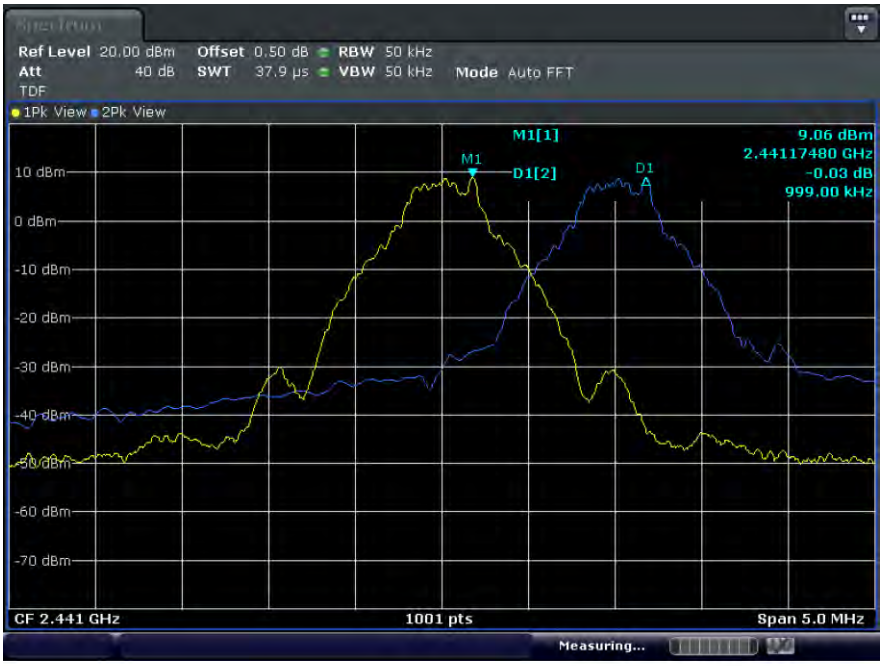
Test mode : EDR_Right

Frequency (㎒)	Adjacent hopping Channel separation (㎑)	Two-third of 20 ㏈ bandwidth (㎑)	Minimum bandwidth (㎑)
2 441	999.00	845.00	25.00

9.4.1. Test plot

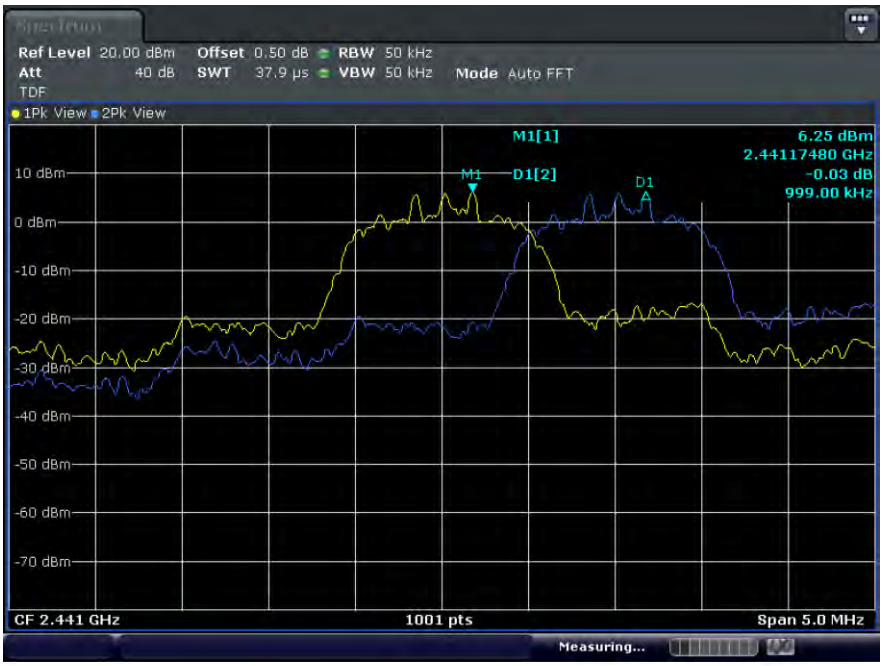
Test mode : BDR_Left

A. Middle Ch. (2 441 MHz)



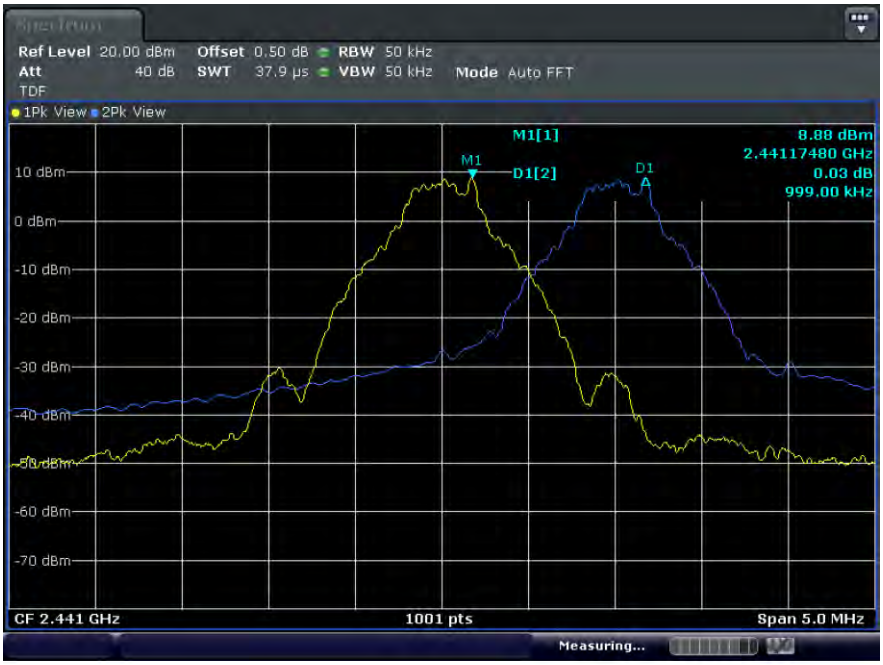
Test mode : EDR_Left

A. Middle Ch. (2 441 MHz)



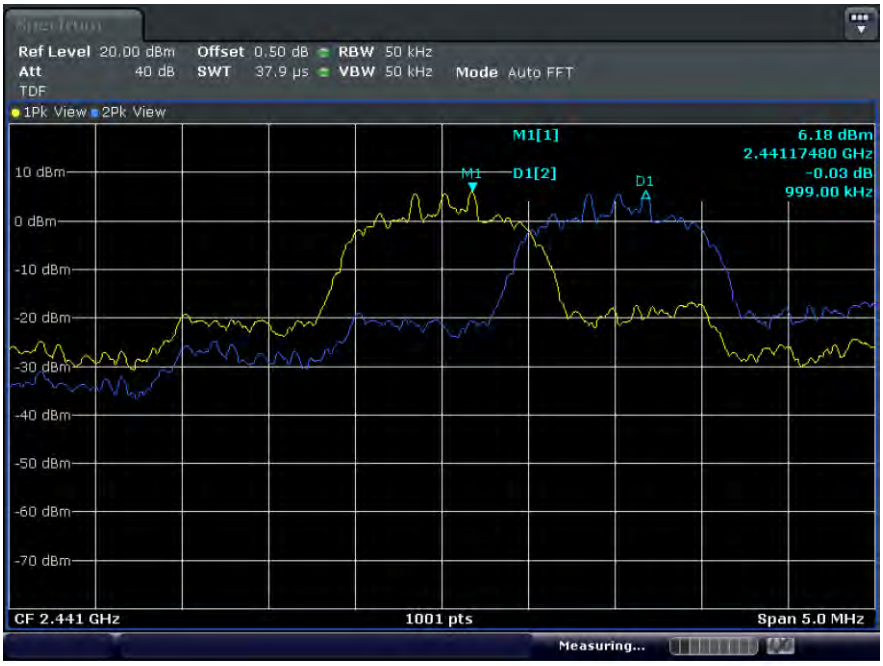
Test mode : BDR_Right

A. Middle Ch. (2 441 MHz)



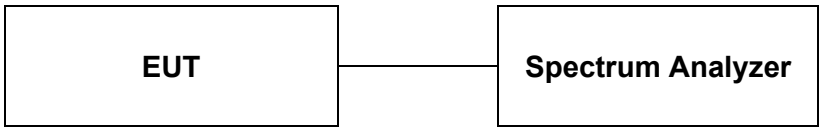
Test mode : EDR_Right

A. Middle Ch. (2 441 MHz)



10. Number of hopping frequencies

10.1. Test setup



10.2. Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5㎒ bands shall use at least15 hopping frequencies.

10.3. Test procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna the port to the Spectrum analyzer
3. Set spectrum analyzer Start = 2400 ㎒, Stop = 2 450 ㎒, Sweep=auto and Start = 2 450 ㎒, Stop =2500 ㎒, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=500 ㎑.
5. Max hold, view and count how many channel in the band.

10.4. Test results

Test mode : BDR_Left

Number of Hopping Frequency	Limit
79	≥ 15

Test mode : EDR_Left

Number of Hopping Frequency	Limit
79	≥ 15

Test mode : BDR_Right

Number of Hopping Frequency	Limit
79	≥ 15

Test mode : EDR_Right

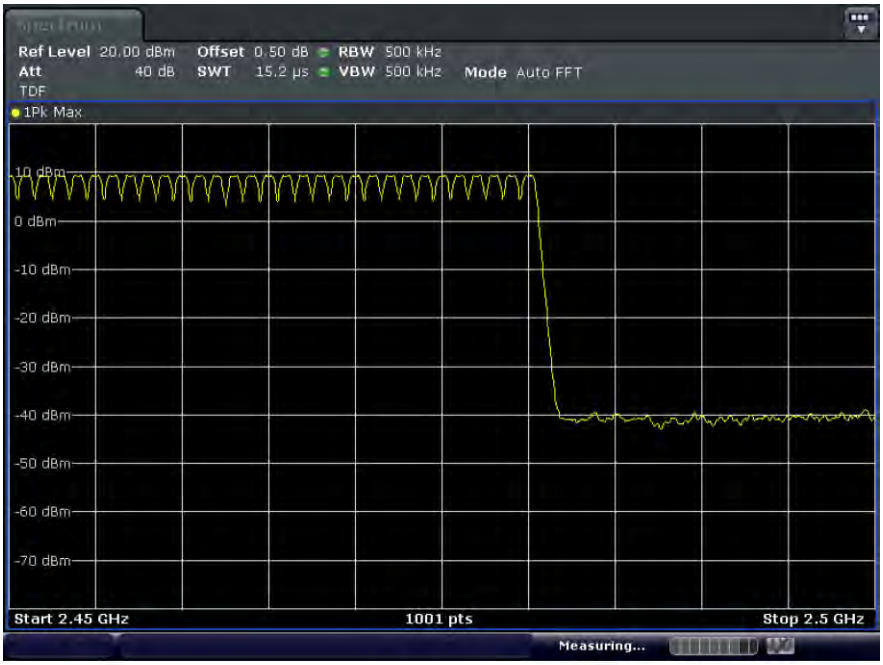
Number of Hopping Frequency	Limit
79	≥ 15

10.4.1. Test plot

Test mode : BDR_Left

A. Lowest Band. (Hopping)

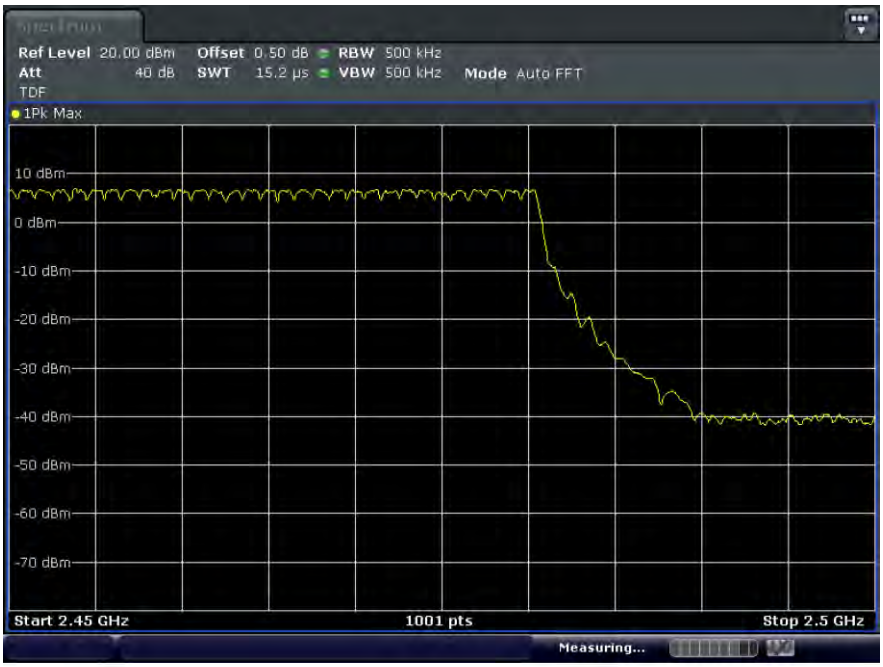
B. Highest Band. (Hopping)



Test mode : EDR_Left

A. Lowest Band. (Hopping)

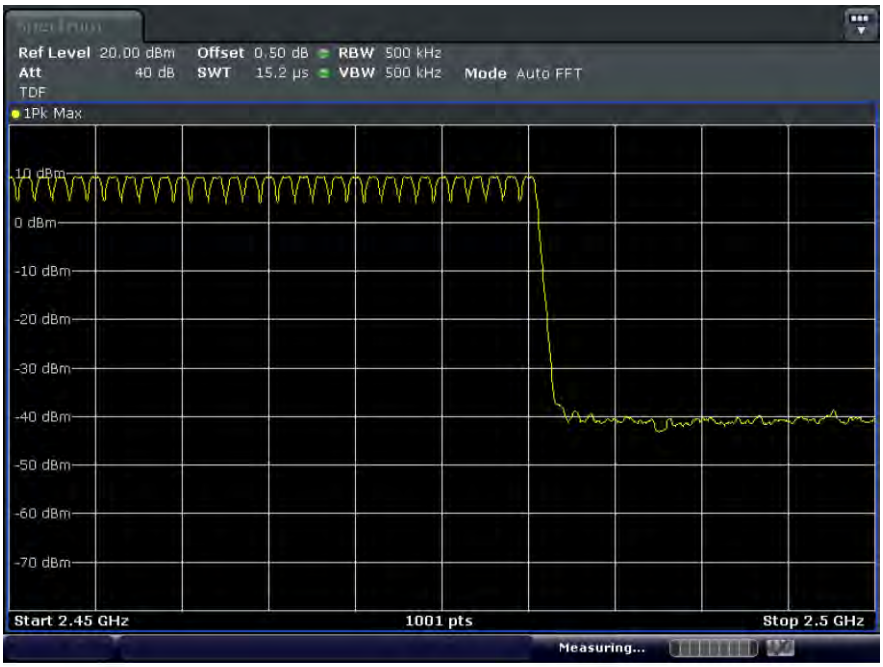
B. Highest Band. (Hopping)



Test mode : BDR_Right

A. Lowest Band. (Hopping)

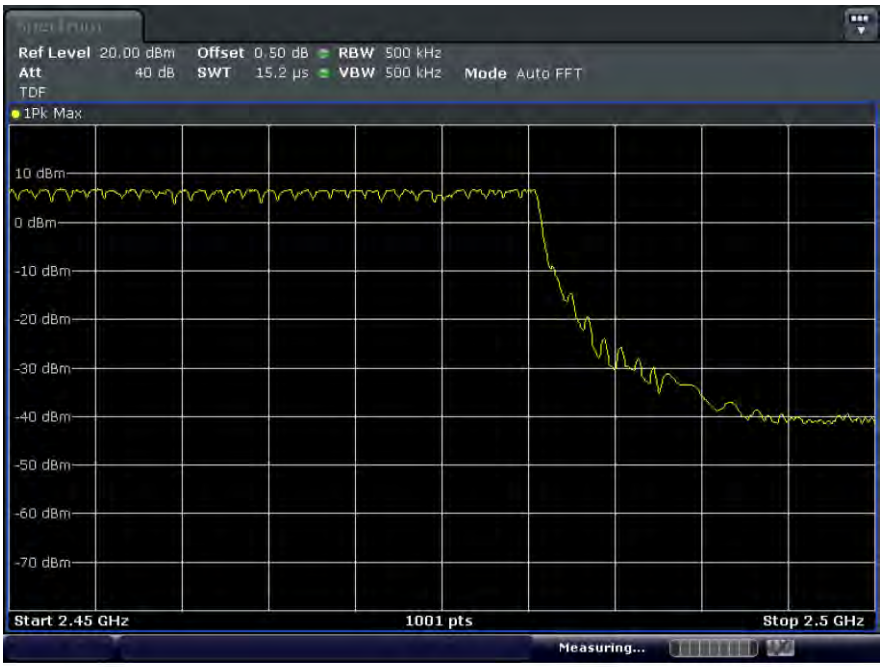
B. Highest Band. (Hopping)



Test mode : EDR_Right

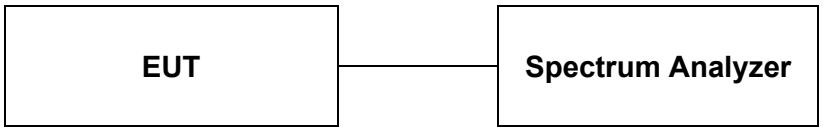
A. Lowest Band. (Hopping)

B. Highest Band. (Hopping)



11. Time of occupancy (Dwell time)

11.1. Test setup



11.2. Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2 400 – 2 483.5 ㎒ band, theaverage timeof occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time = 0.4(s) * 79 = 31.6(s)

11.3. Test procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable.
3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.
6. The hopping rate is1 600 per second.

11.4. Test results

Measurement data : refer to the next page

Test mode : BDR_Left

On Time [ms]	Hopping Rate	Result [s]	Limit [s]
2.88	266.67	0.31	0.40

Test mode : EDR_Left

On Time [ms]	Hopping Rate	Result [s]	Limit [s]
2.89	266.67	0.31	0.40

Test mode : BDR_Right

On Time [ms]	Hopping Rate	Result [s]	Limit [s]
2.89	266.67	0.31	0.40

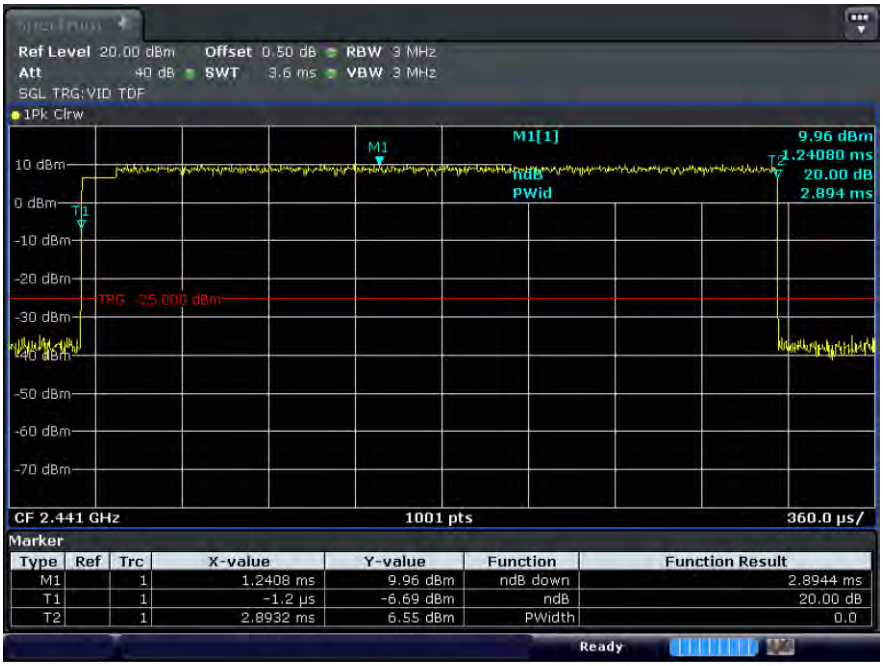
Test mode : EDR_Right

On Time [ms]	Hopping Rate	Result [s]	Limit [s]
2.89	266.67	0.31	0.40

11.4.1. Test plot

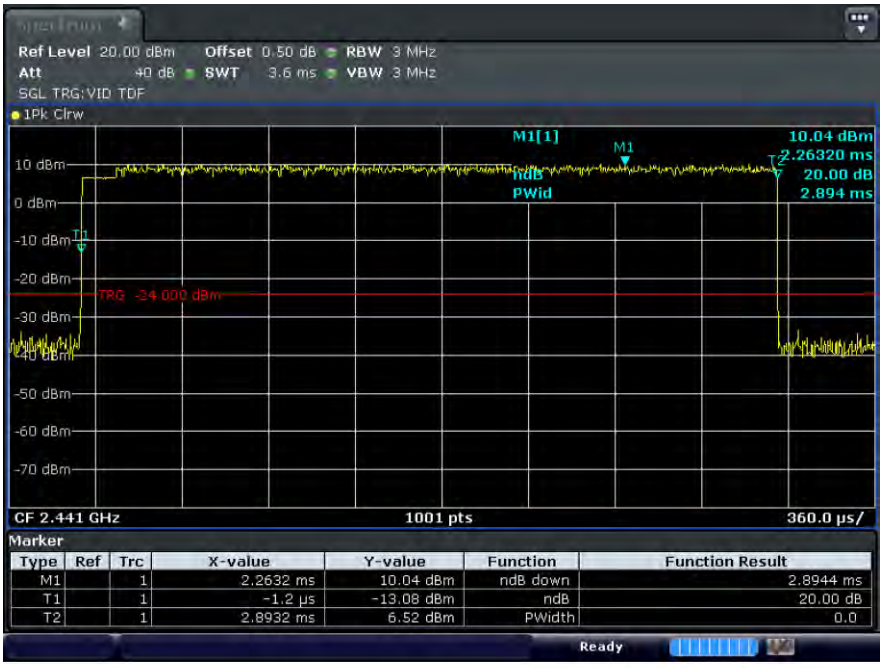
Test mode : BDR_Left

Test mode : EDR_Left



Test mode : BDR_Right

Test mode : EDR_Right

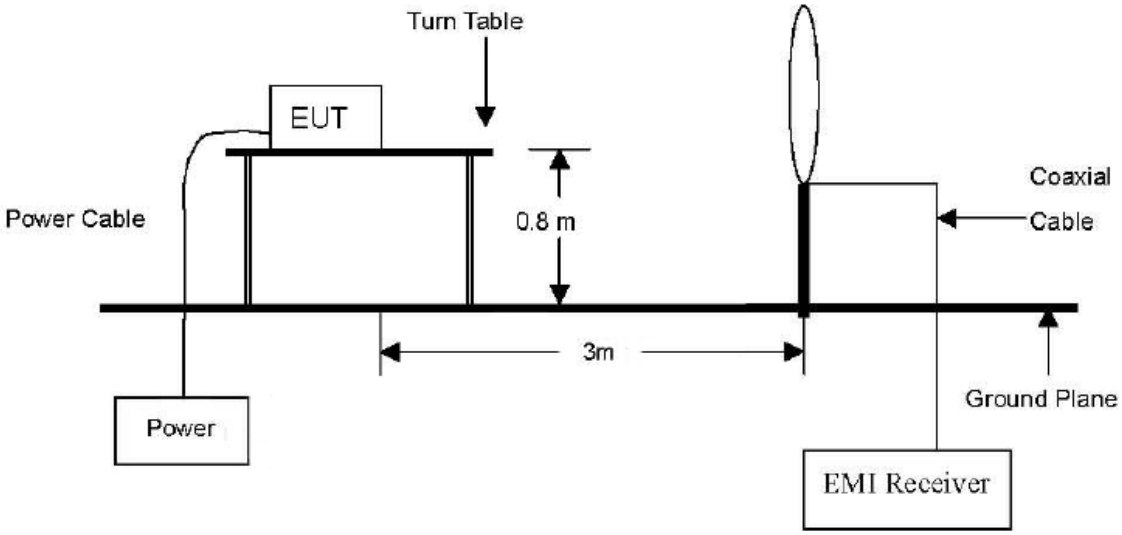


12. Transmitter radiated spurious emissions and conducted spurious emissions

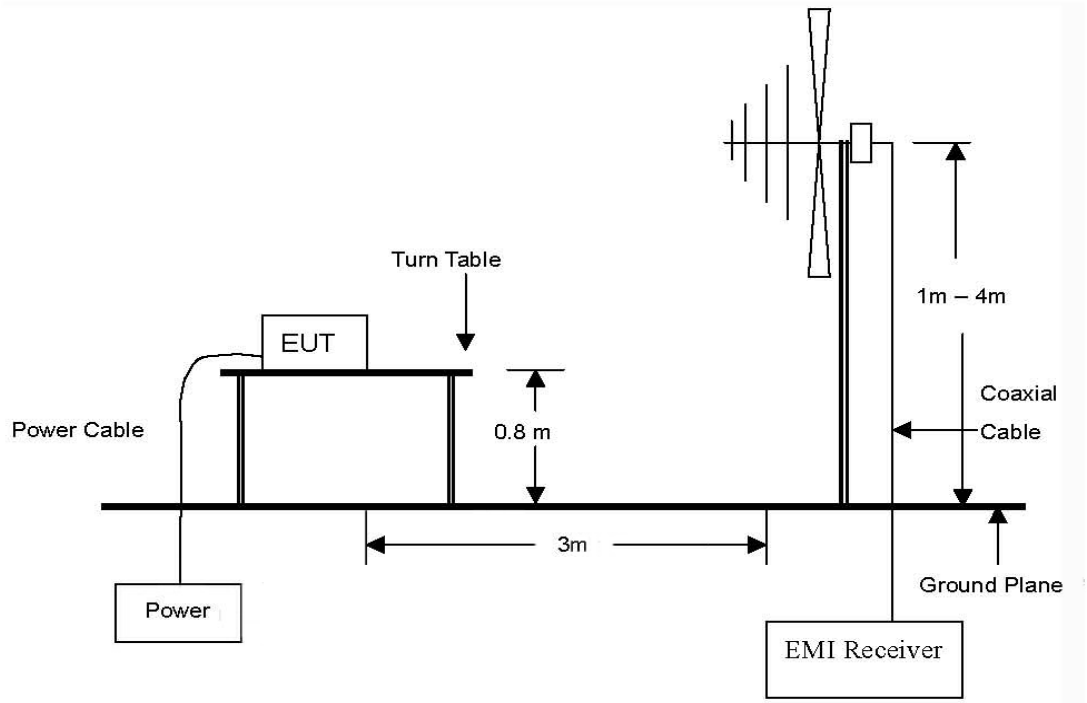
12.1. Test setup

12.1.1. Transmitter radiated spurious emissions

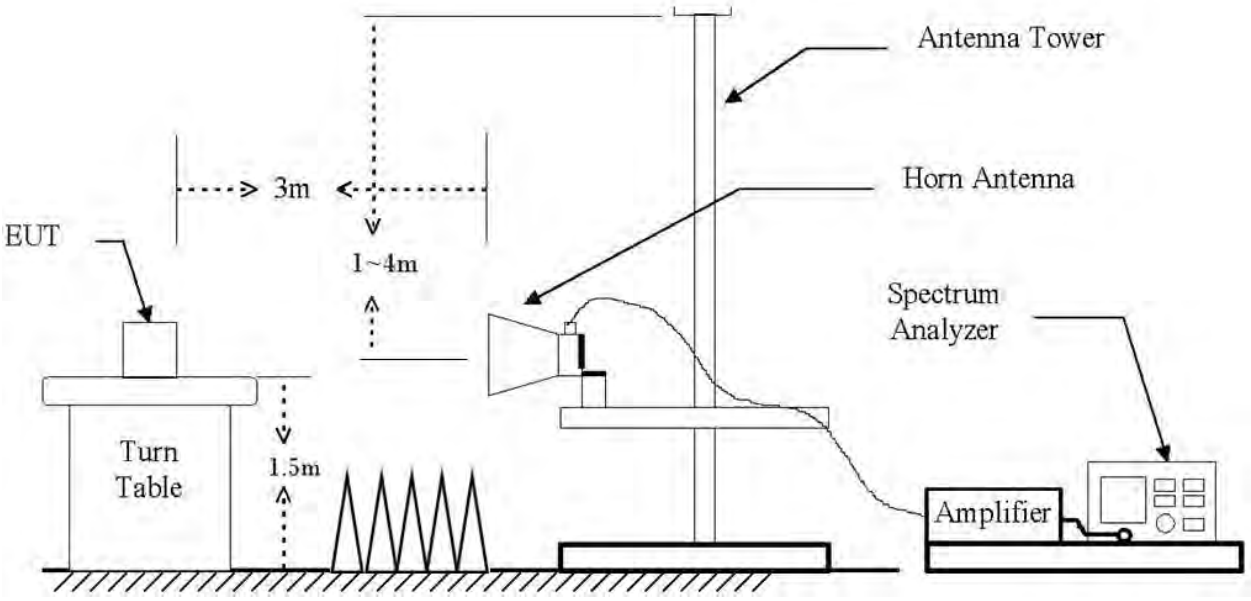
The diagram below shows the test setup that is utilized to make the measurements for emission from 9kHz to 30MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 40 ㎓ emissions.



12.2. Limit

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))
According to § 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated at 3M (㏈㎶/m)	Radiated (㎶/m)
0.009–0.490	300	See the remark	2400/F(㎑)
0.490–1.705	30		24000/F(㎑)
1.705–30.0	30		30
30 - 88	3	40.0	100
88 – 216	3	43.52	150
216 – 960	3	46.02	200
Above 960	3	53.97	500

※Remark

1. Emission level in ㏈uV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Distance extrapolation factor =20log(Specific distance/ test distance)(㏈)
   Limit line=Specific limits(㏈uV) + distance extrapolation factor.

12.3. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10:2013
In case of the air temperature of the test site is out of the range is 10 to 40°C before the testing proceeds the warm-up time of EUT maintain adequately

12.3.1. Test procedures for radiated spurious emissions

1. The EUT is placed on a turntable, which is 0.8 m (Below 1 ㎓.)/ 1.5 m (Above 1 ㎓) above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

※Remark

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 ㎑ for Peak detection (PK) at frequency below 30 ㎒
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 ㎓.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒z and the video bandwidth is 10 ㎐ for Average detection (AV) at frequency above 1 ㎓.

12.3.2. Test procedures for conducted spurious emissions

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑, VBW=100 ㎑.

12.4. Test results

12.4.1. Radiated spurious emissions (9 kHz to 30 MHz)

The frequency spectrum from 9㎑ to 30㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈. All reading values are peak values.
To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

Test mode : BDR_Right_2 402 MHz (Worst case)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
No other emissions were detected at a level greater than 20dB below limit.					

※Remark

1. Result = Reading + Ant. factor - Amp + CL (Cable loss)
2. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

12.4.2. Radiated spurious emissions (30 MHz to 1 000 MHz)

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈. All reading values are peak values.
To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

Test mode : BDR_Right_2 402 MHz (Worst case)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
68.98	QP	V	16.80	40.00	23.20
158.48	QP	V	23.40	43.50	20.10
426.82	QP	V	21.40	46.00	24.60
Above 500 MHz Not detected					

※Remark

1. Result = Reading + Ant. factor - Amp + CL (Cable loss)
2. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

12.4.3. Radiated spurious emissions & Bandedge (Above 1 000 MHz)

The frequency spectrum above 1 000 ㎒was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈.
To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

Test mode : BDR_Left

A. Lowest Ch. (2 402 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 332.58	Peak	V	38.79	74.00	35.21
*4 804.20	Peak	V	53.40	74.00	20.60
Above 5 000 MHz Not detected					

B. Middle Ch. (2 441 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 881.72	Peak	V	50.99	74.00	23.01
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

C. Highest Ch. (2 480 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 499.04	Peak	V	33.50	74.00	40.50
*4 959.69	Peak	H	50.39	74.00	23.61
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

Test mode : EDR_Left

A. Lowest Ch. (2 402 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 332.42	Peak	V	38.62	74.00	35.38
*4 803.85	Peak	V	53.06	74.00	20.94
Above 5 000 MHz Not detected					

B. Middle Ch. (2 441 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 881.87	Peak	V	49.57	74.00	24.43
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

C. Highest Ch. (2 480 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 498.87	Peak	H	34.58	74.00	39.42
*4 959.99	Peak	H	49.95	74.00	24.05
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

Test mode : BDR_Right

A. Lowest Ch. (2 402 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 342.32	Peak	V	37.91	74.00	36.09
*4 803.95	Peak	V	53.85	74.00	20.15
Above 5 000 MHz Not detected					

B. Middle Ch. (2 441 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 882.07	Peak	V	50.96	74.00	23.04
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

C. Highest Ch. (2 480 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 499.81	Peak	H	33.73	74.00	40.27
*4 960.39	Peak	H	50.06	74.00	23.94
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

Test mode : EDR_Right

A. Lowest Ch. (2 402 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 355.04	Peak	H	38.65	74.00	35.35
*4 803.65	Peak	V	52.65	74.00	21.35
Above 5 000 MHz Not detected					

B. Middle Ch. (2 441 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 881.67	Peak	V	49.66	74.00	24.34
Above 5 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

C. Highest Ch. (2 480 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 499.99	Peak	V	34.20	74.00	39.80
*4 959.79	Peak	H	49.16	74.00	24.84
Above 5 000 MHz Not detected					

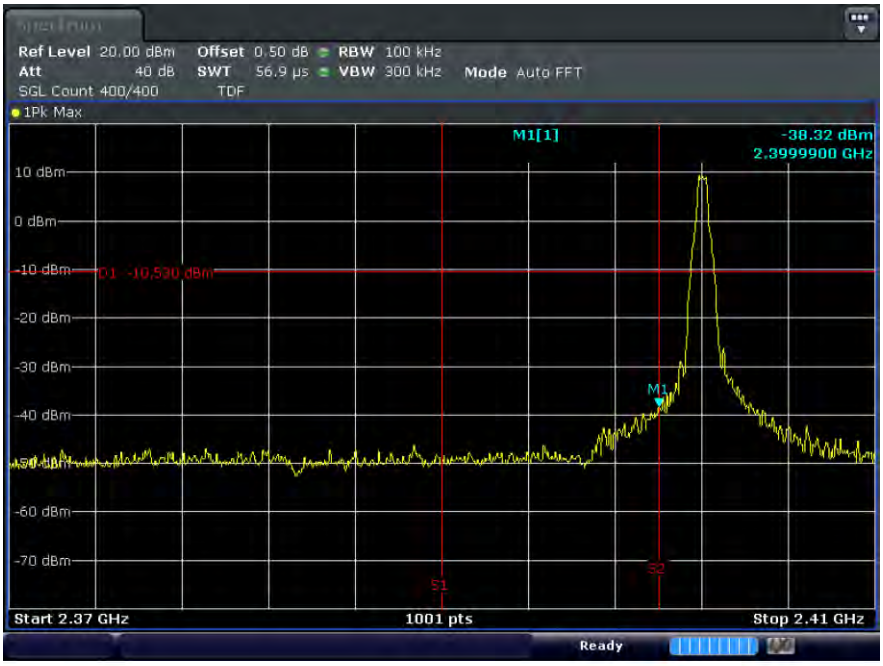
※Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Result = Reading + Ant. factor - Amp + CL (Cable loss) + DCCF
4. 15.31 Measurement standards.
The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.
5. * is Restricted band.
6. DCCF(Duty Cycle Correction Factor) = 20 x Log(Worst case dwell time / 100 ms) dB
Refer to 12.4.5
7. Average measurement did not take place because the peak data did not exceed average limit

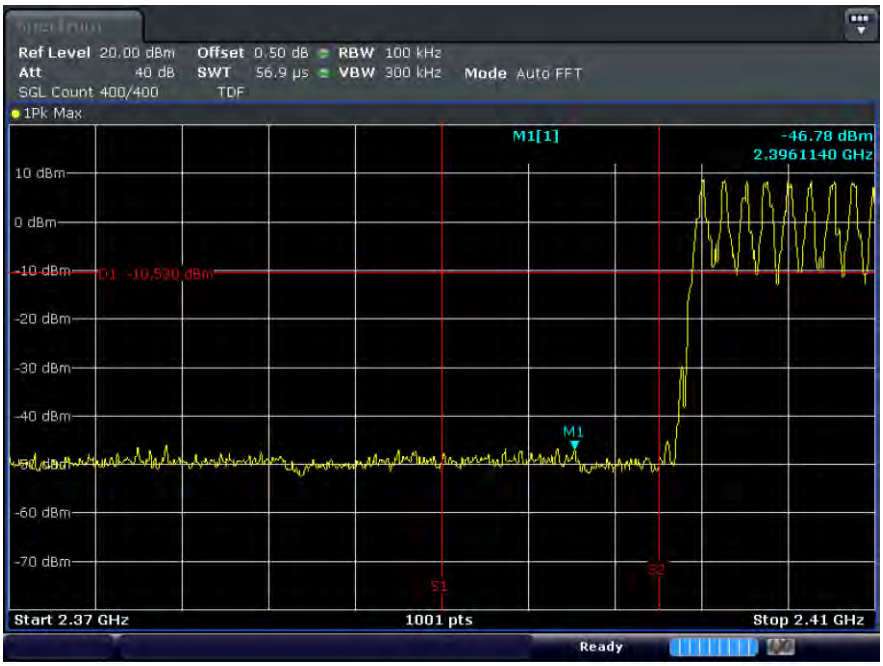
12.4.4. Test plot (Conducted spurious emissions & Bandedge)

Test mode : BDR_Left

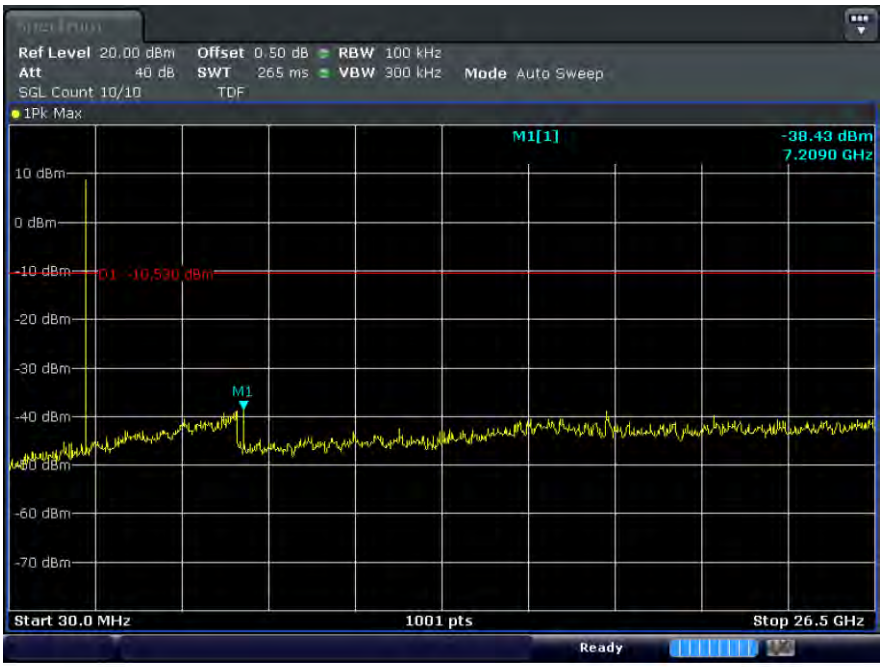
A.1. Lowest Ch. (2 402 MHz)_Band edge



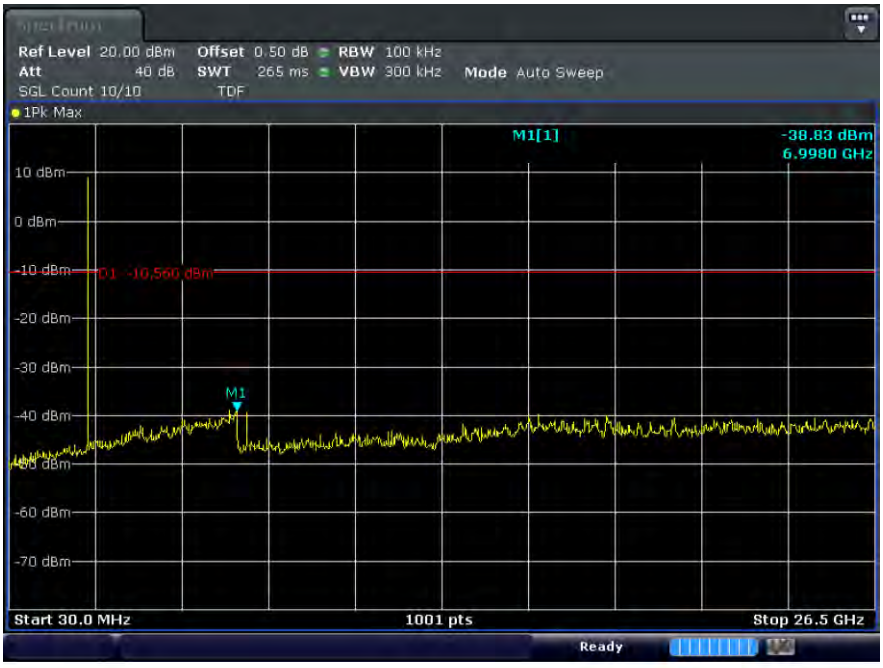
A.2. Lowest Ch. (2 402 MHz)_Band edge(Hopping)



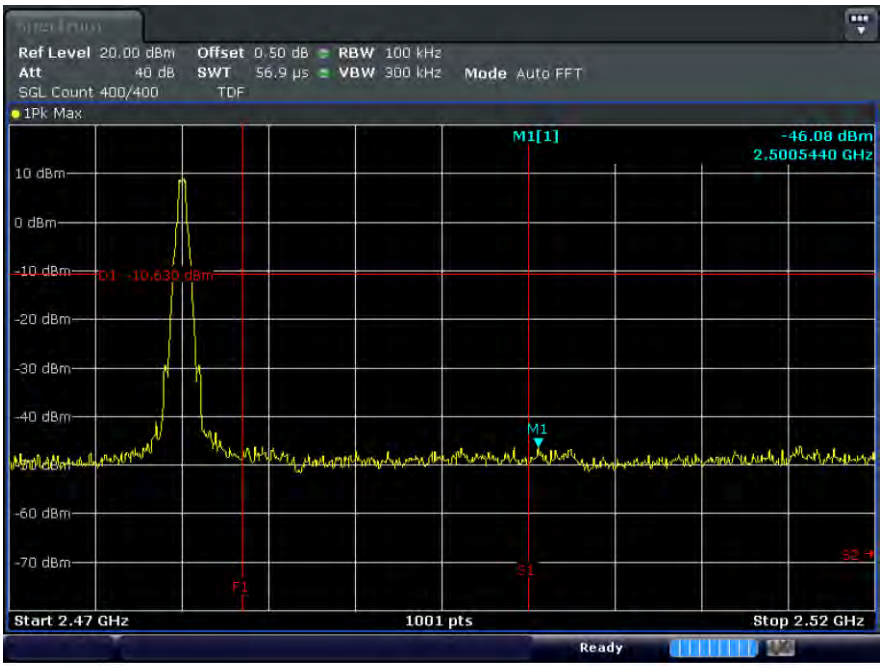
A.3. Lowest Ch. (2 402 MHz)_Spurious emissions



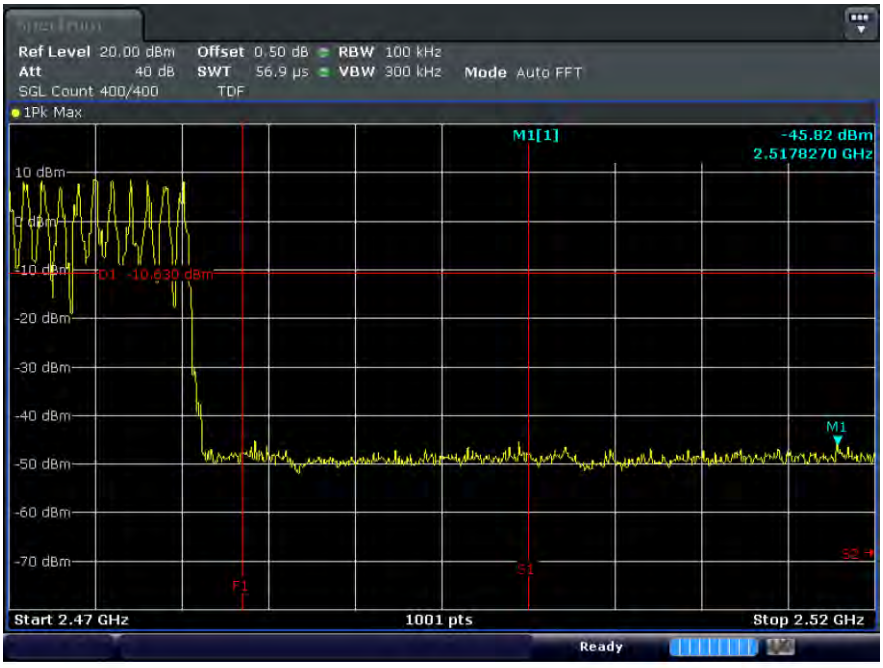
B.1. Middle Ch. (2 441 MHz)_Spurious emissions



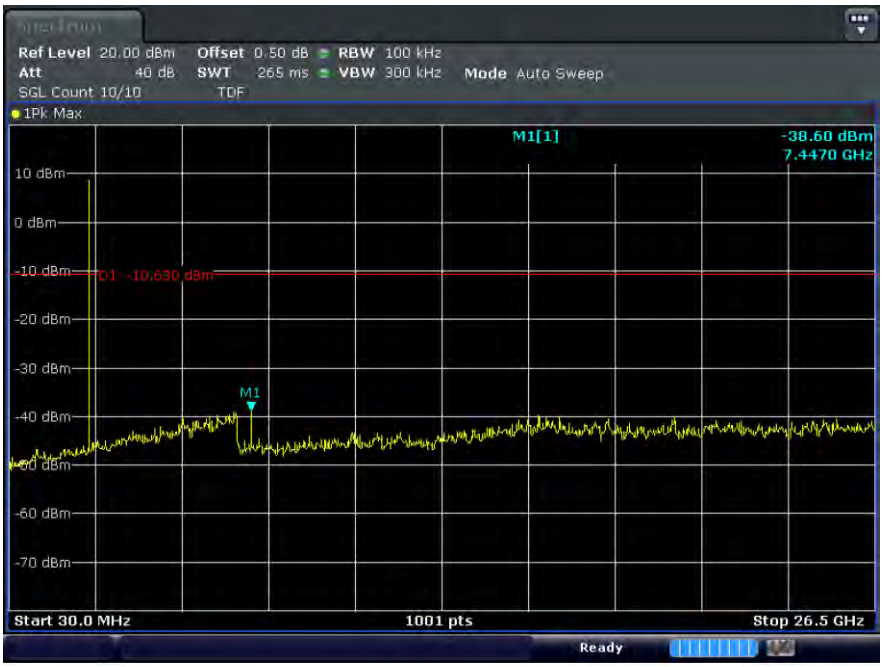
C.1. Highest Ch. (2 480 MHz)_Band edge



C.2. Highest Ch. (2 480 MHz)_Band edge(Hopping)

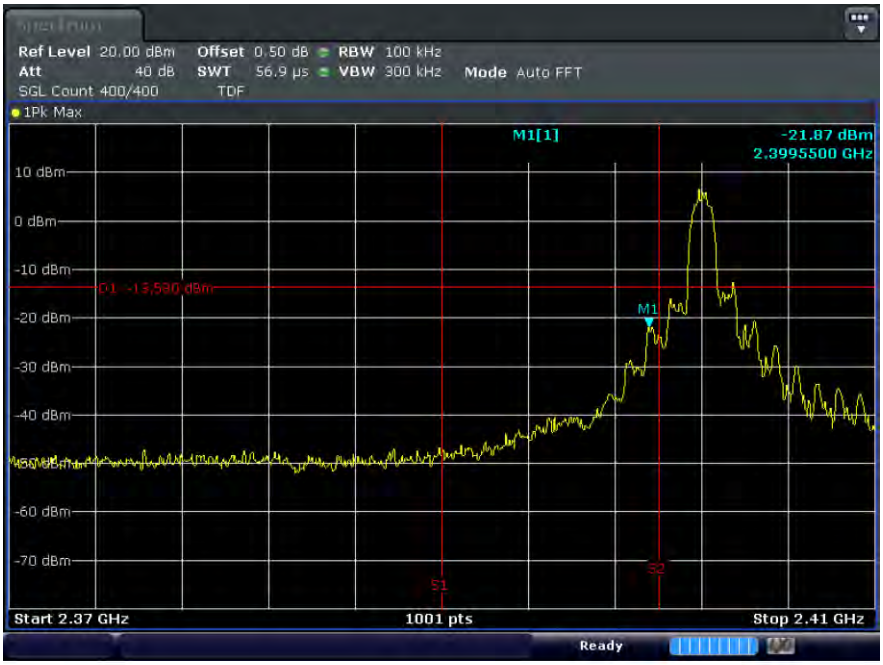


C.3. Highest Ch. (2 480 MHz)_Spurious emissions

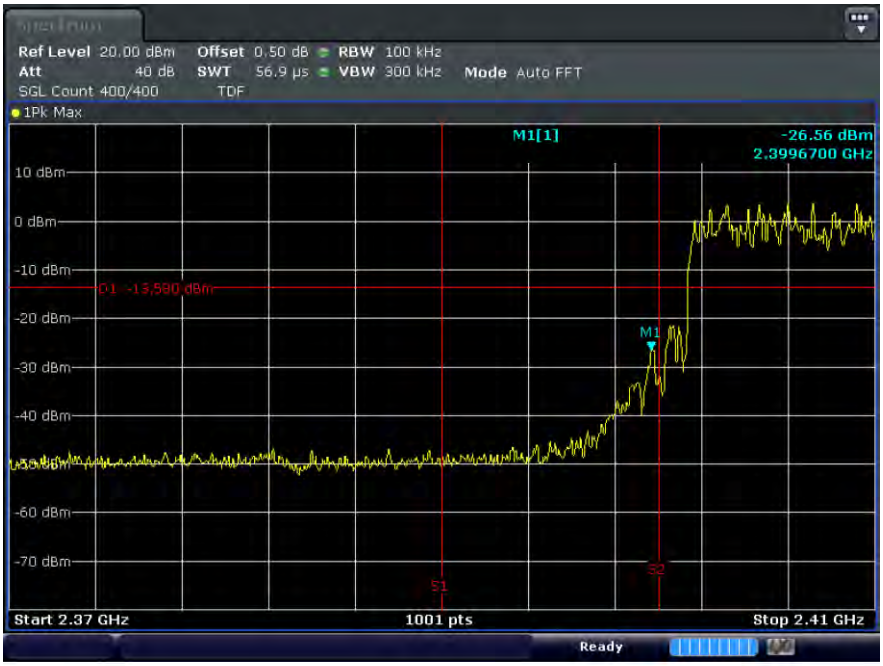


Test mode : EDR_Left

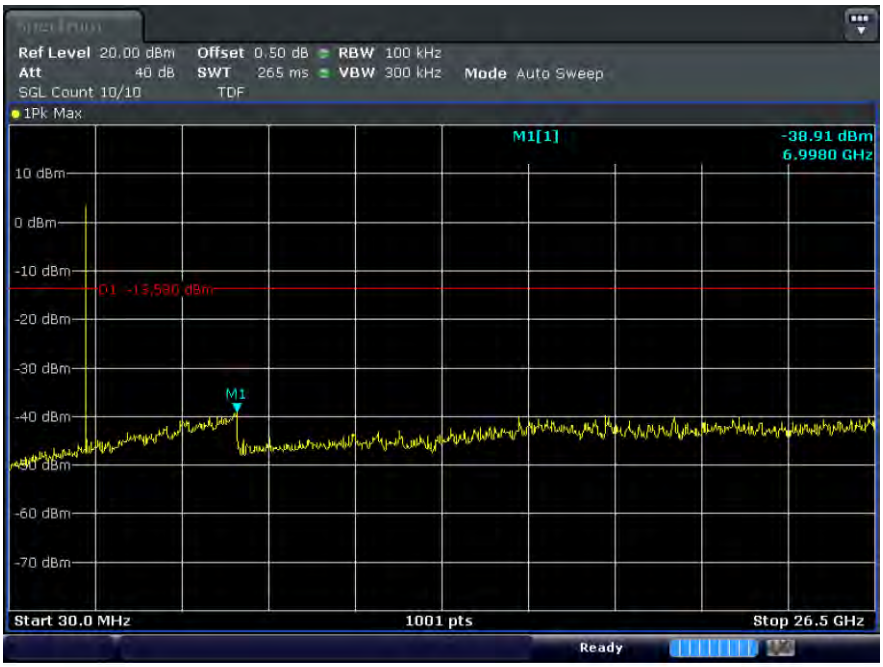
A.1. Lowest Ch. (2 402 MHz)_Band edge



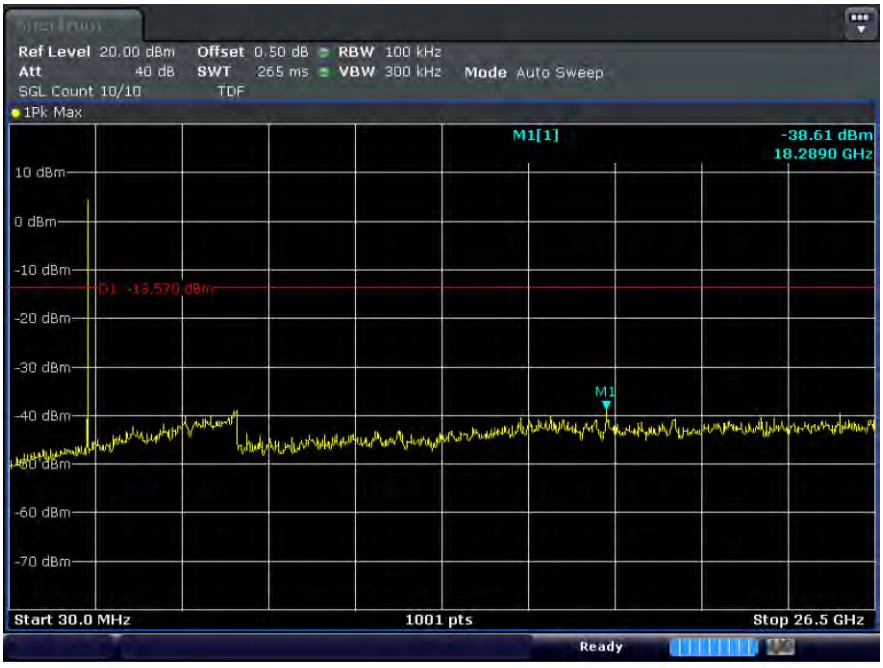
A.2. Lowest Ch. (2 402 MHz)_Band edge(Hopping)



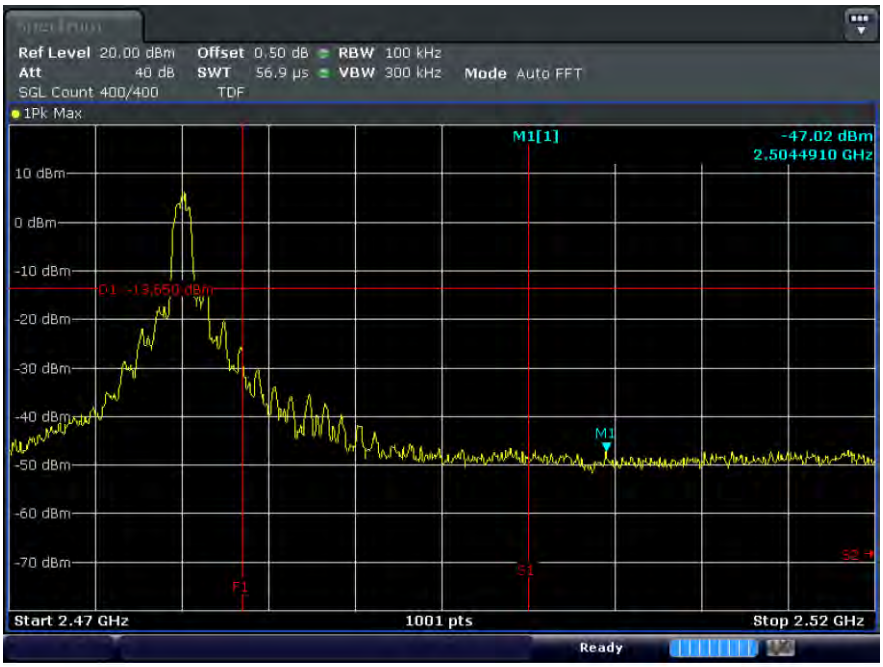
A.3. Lowest Ch. (2 402 MHz)_Spurious emissions



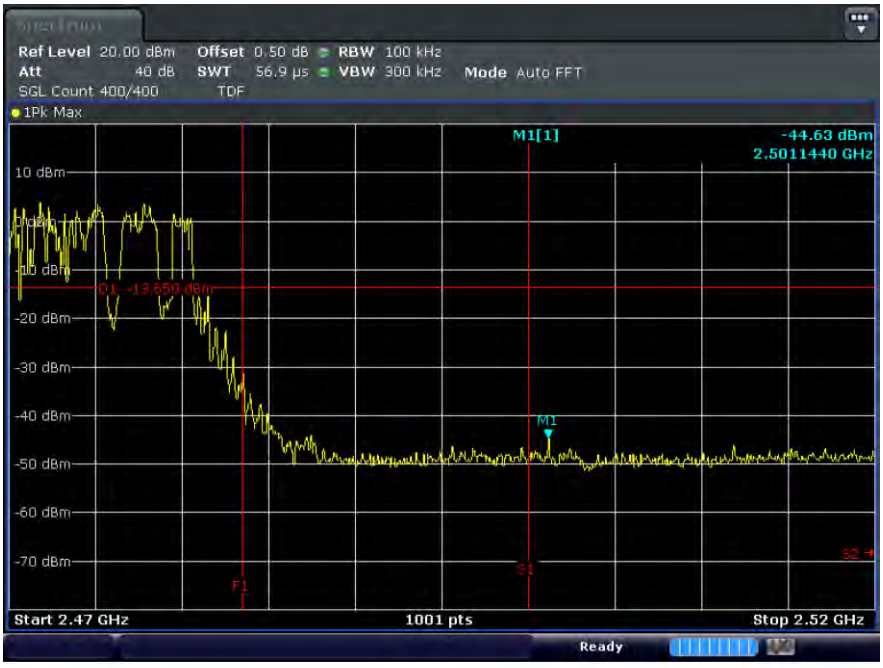
B.1. Middle Ch. (2 441 MHz)_Spurious emissions



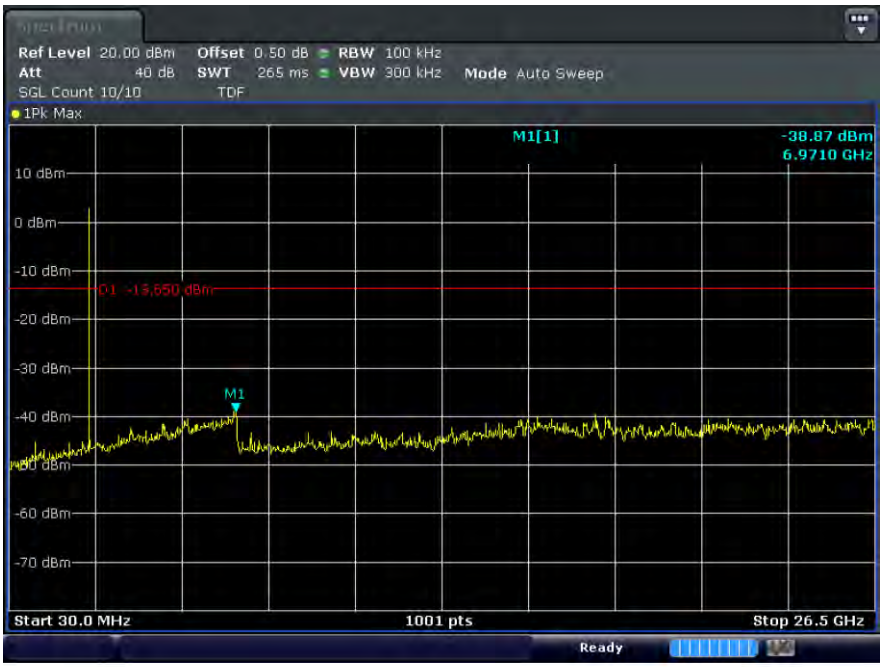
C.1. Highest Ch. (2 480 MHz)_Band edge



C.2. Highest Ch. (2 480 MHz)_Band edge(Hopping)

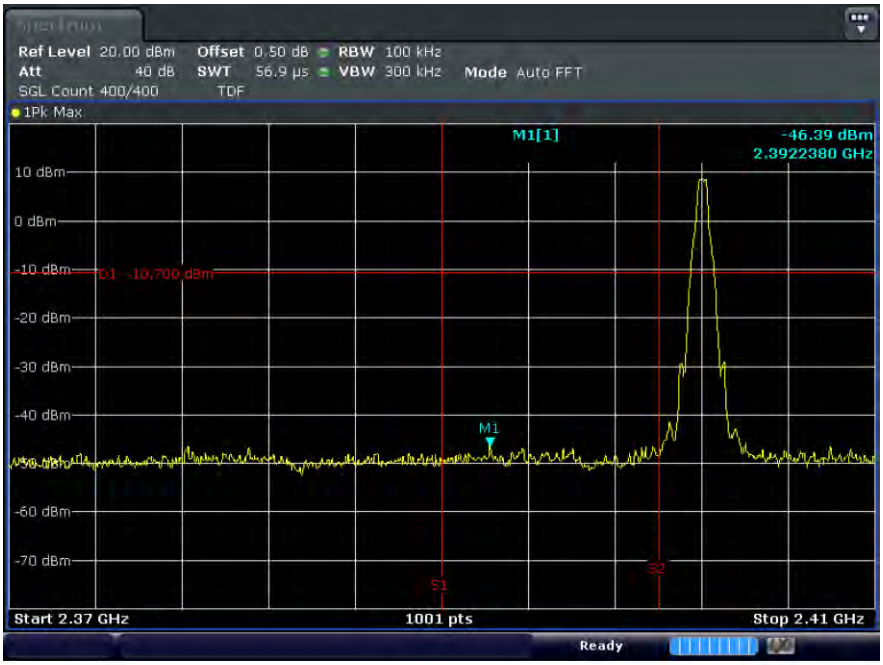


C.3. Highest Ch. (2 480 MHz)_Spurious emissions

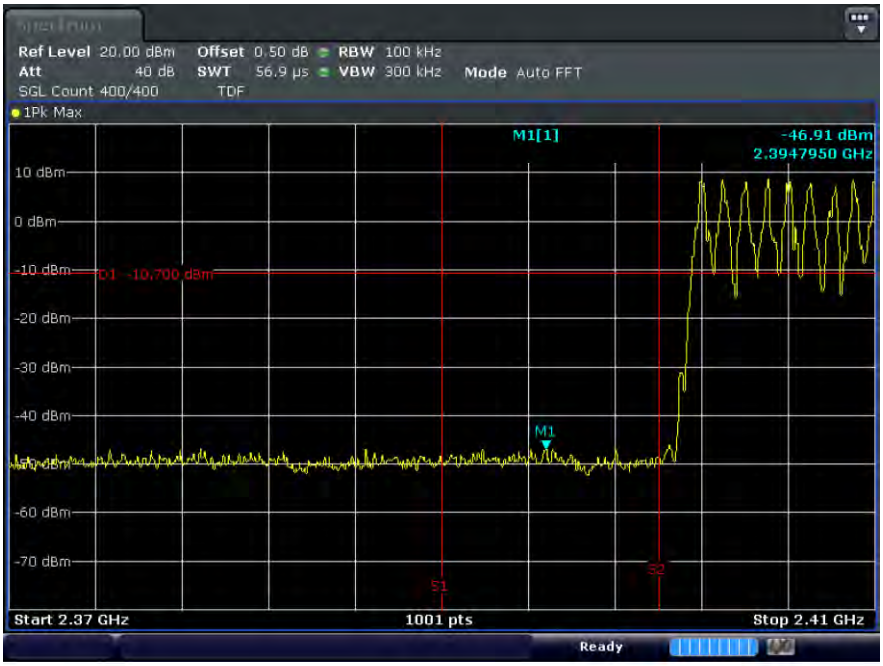


Test mode : BDR_Right

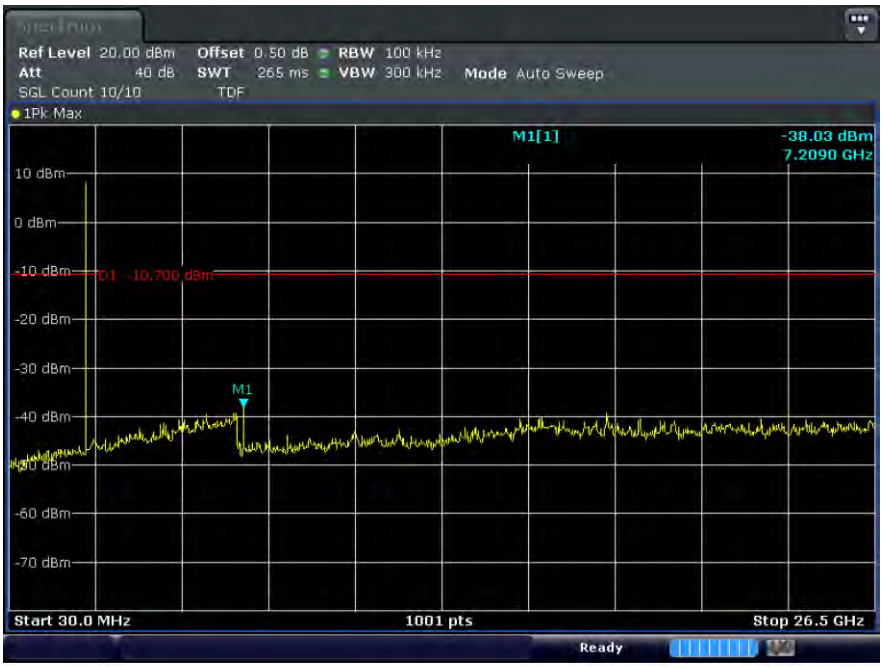
A.1. Lowest Ch. (2 402 MHz)_Band edge



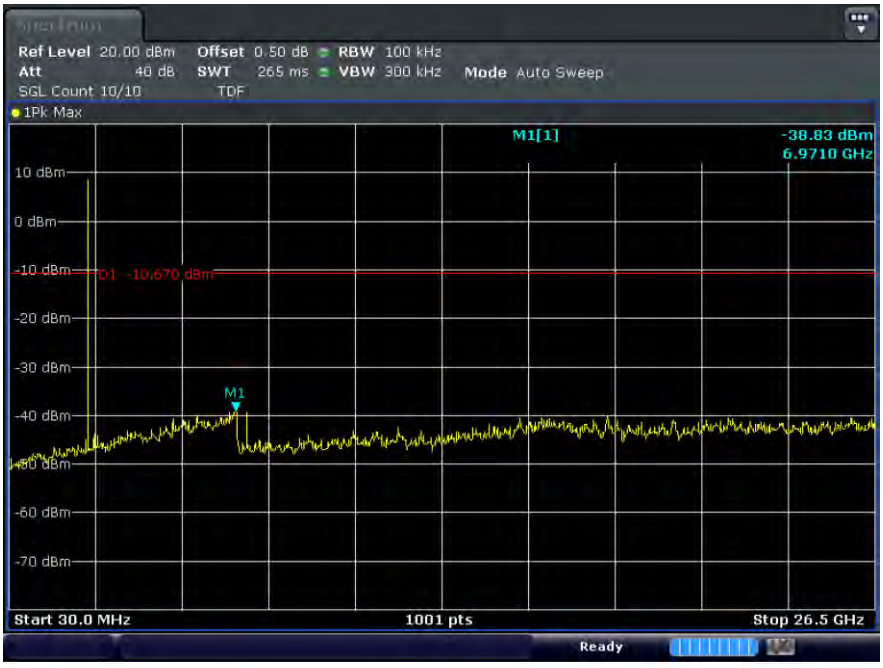
A.2. Lowest Ch. (2 402 MHz)_Band edge(Hopping)



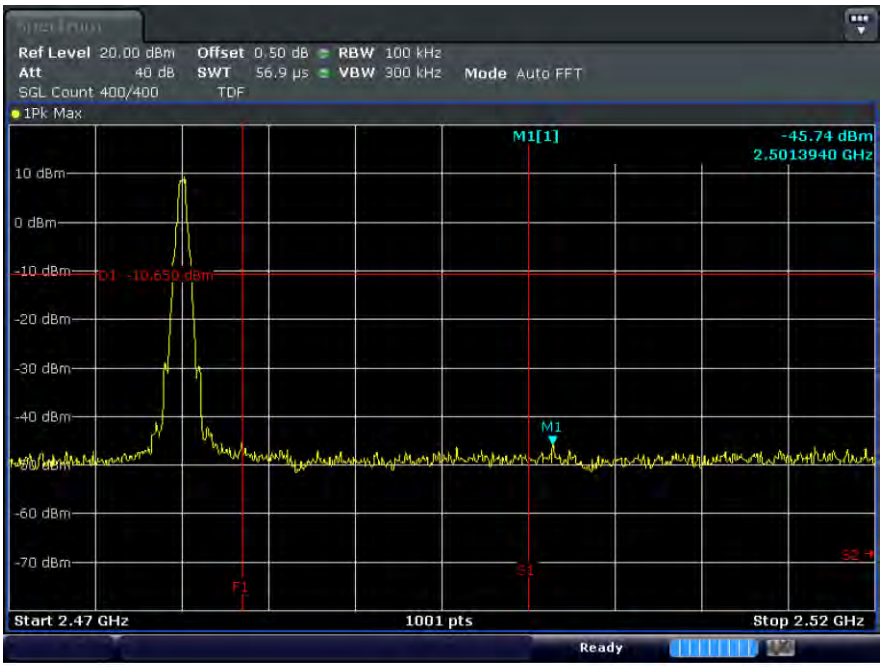
A.3. Lowest Ch. (2 402 MHz)_Spurious emissions



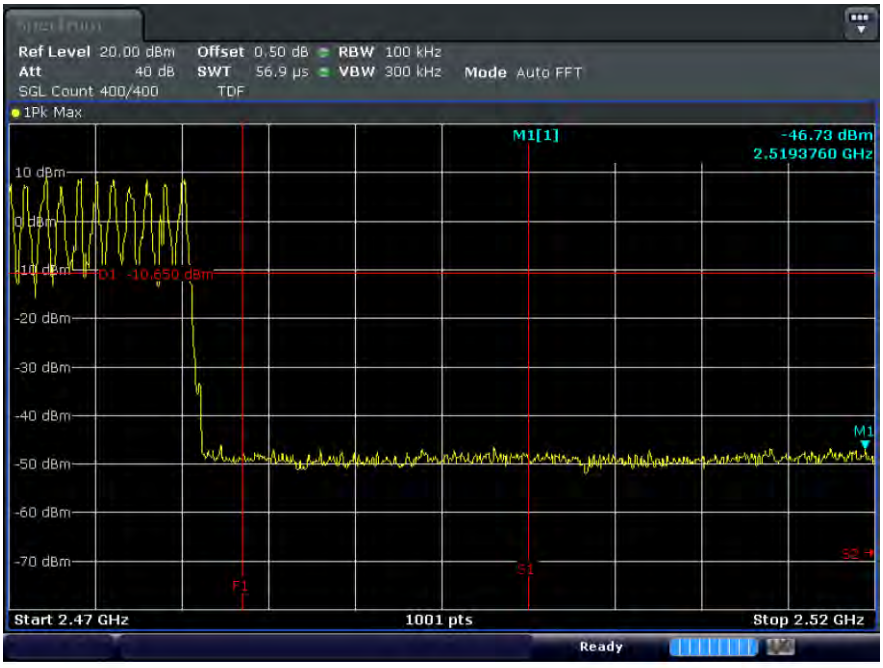
B.1. Middle Ch. (2 441 MHz)_Spurious emissions



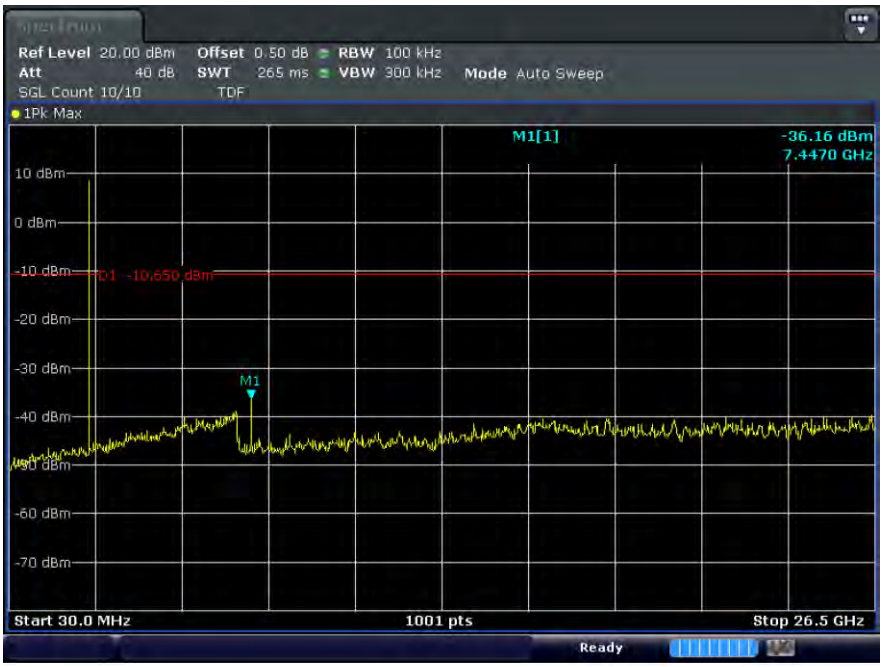
C.1. Highest Ch. (2 480 MHz)_Band edge



C.2. Highest Ch. (2 480 MHz)_Band edge(Hopping)

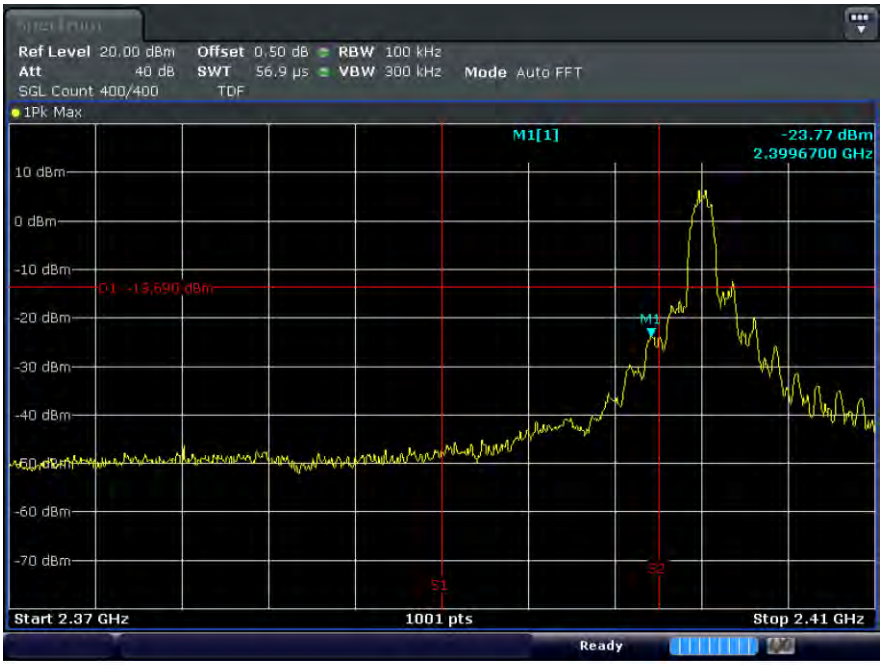


C.3. Highest Ch. (2 480 MHz)_Spurious emissions



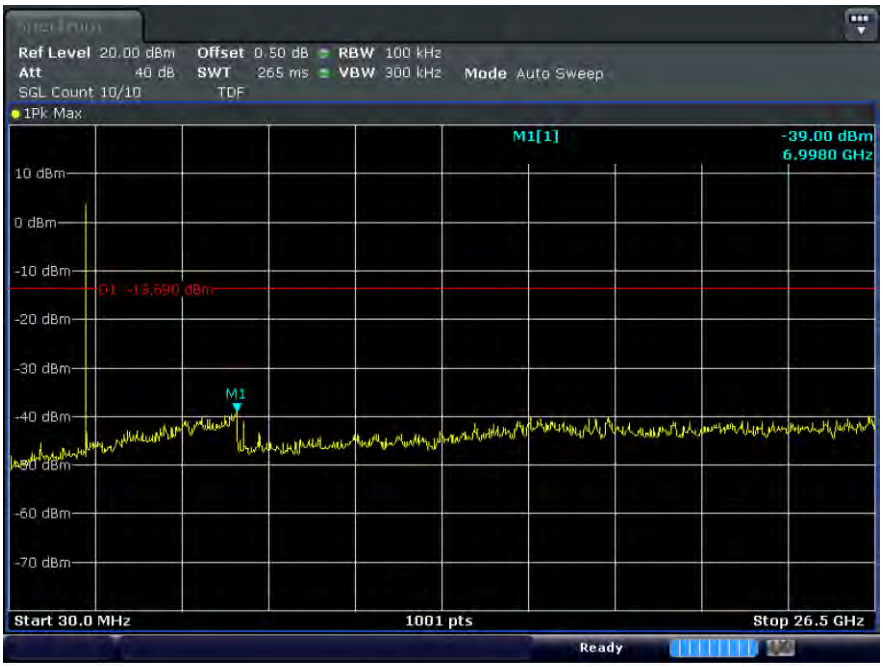
Test mode : EDR_Right

A.1. Lowest Ch. (2 402 MHz)_Band edge

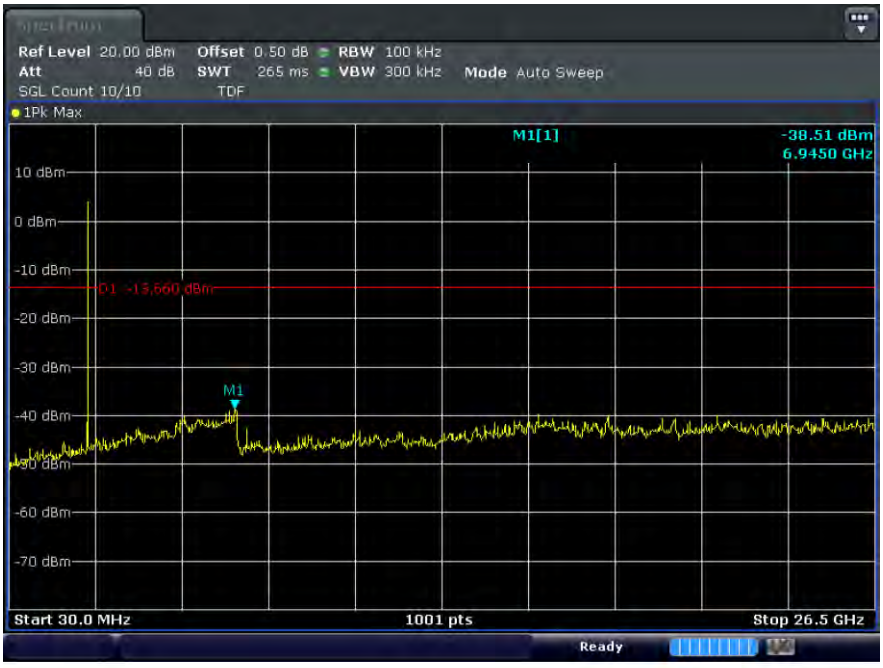


A.2. Lowest Ch. (2 402 MHz)_Band edge(Hopping)

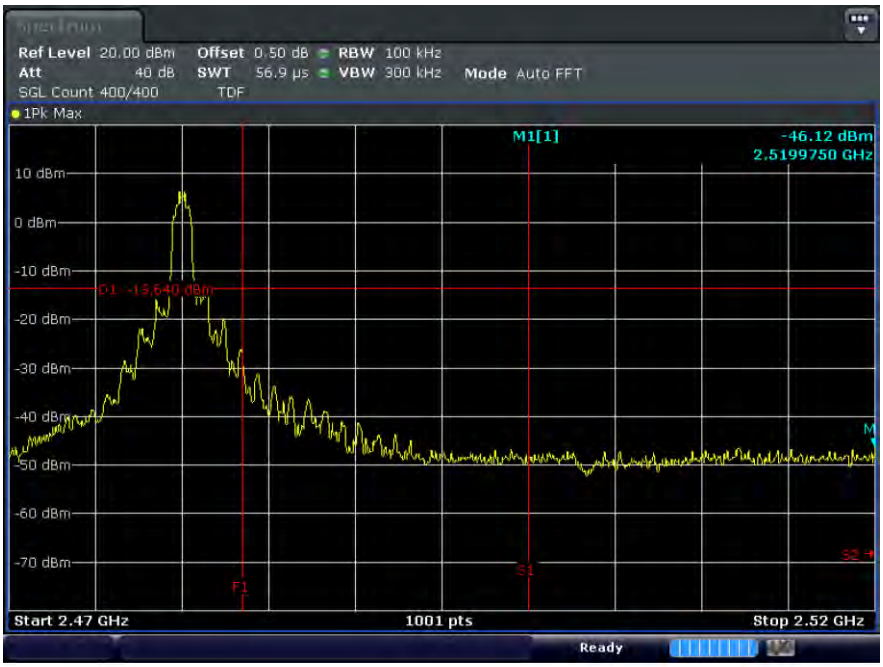
A.3. Lowest Ch. (2 402 MHz)_Spurious emissions



B.1. Middle Ch. (2 441 MHz)_Spurious emissions

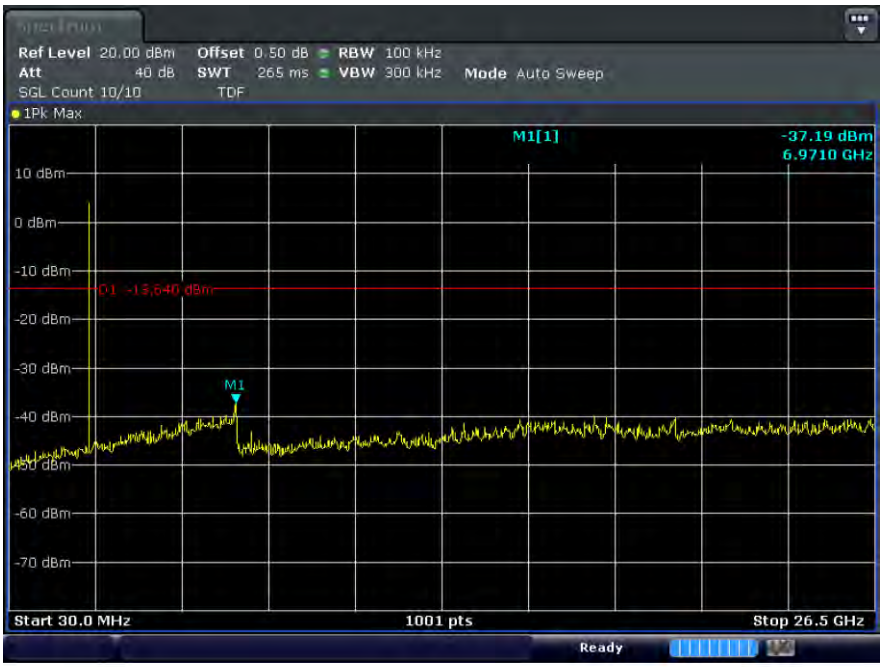


C.1. Highest Ch. (2 480 MHz)_Band edge



C.2. Highest Ch. (2 480 MHz)_Band edge(Hopping)

C.3. Highest Ch. (2 480 MHz)_Spurious emissions

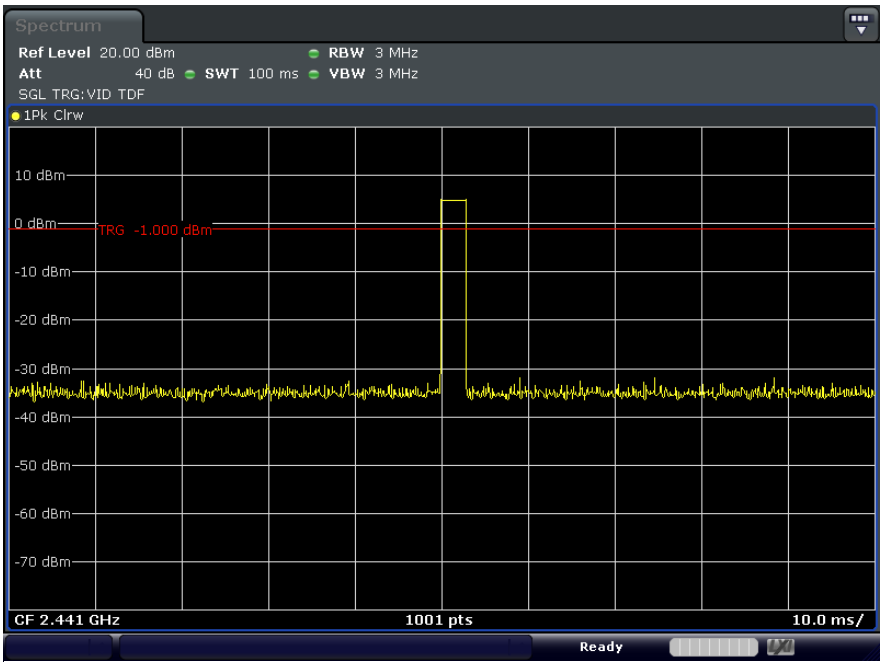


12.4.5. Test plot (Duty Cycle Correction Factor)

Test mode : BDR_Left

A.1. Middle Ch. (2 441 MHz)_Duty Cycle

A.2. Middle Ch. (2 441 MHz)_DCCF 100 ms

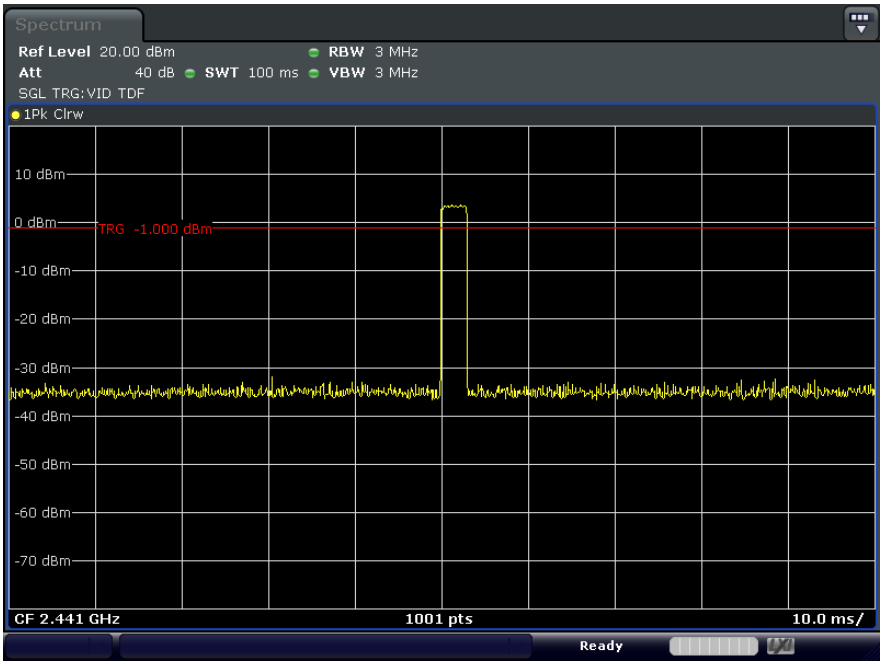


Note 1 : Worst case dwell time = Burst on time * No. of hop
Note 2 : DCCF = 20 * Log(Worst case dwell time / 100 ms) = 20 * log(2.87 / 100) = -30.84

Test mode : EDR_Left

A.1. Middle Ch. (2 441 MHz)_ Duty Cycle

A.2. Middle Ch. (2 441 MHz)_DCCF 100 ms

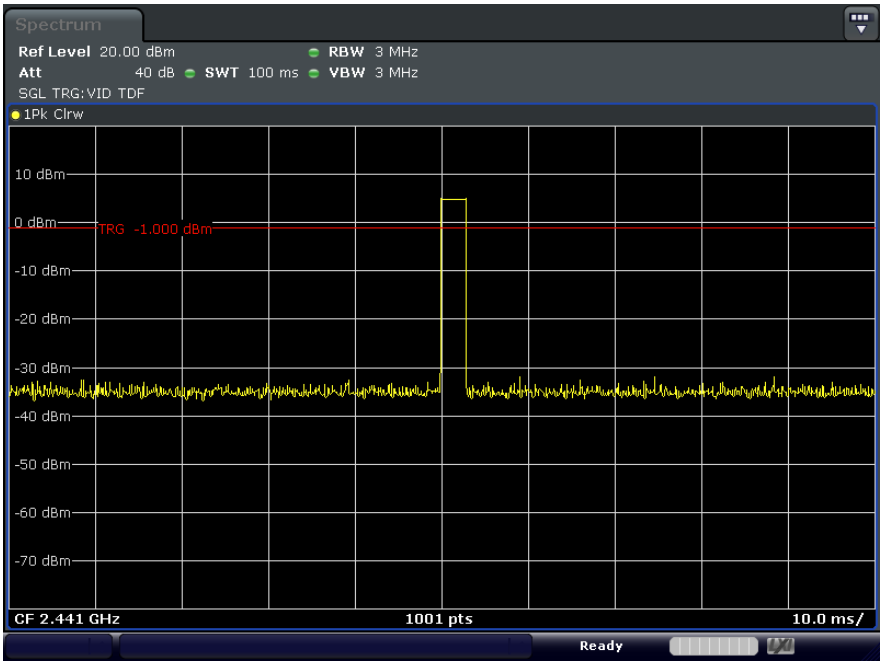


Note 1 : Worst case dwell time = Burst on time * No. of hop
Note 2 : DCCF = 20 * Log(Worst case dwell time / 100 ms) = 20 * log(2.88 / 100) = -30.81

Test mode : BDR_Right

A.1. Middle Ch. (2 441 MHz)_Duty Cycle

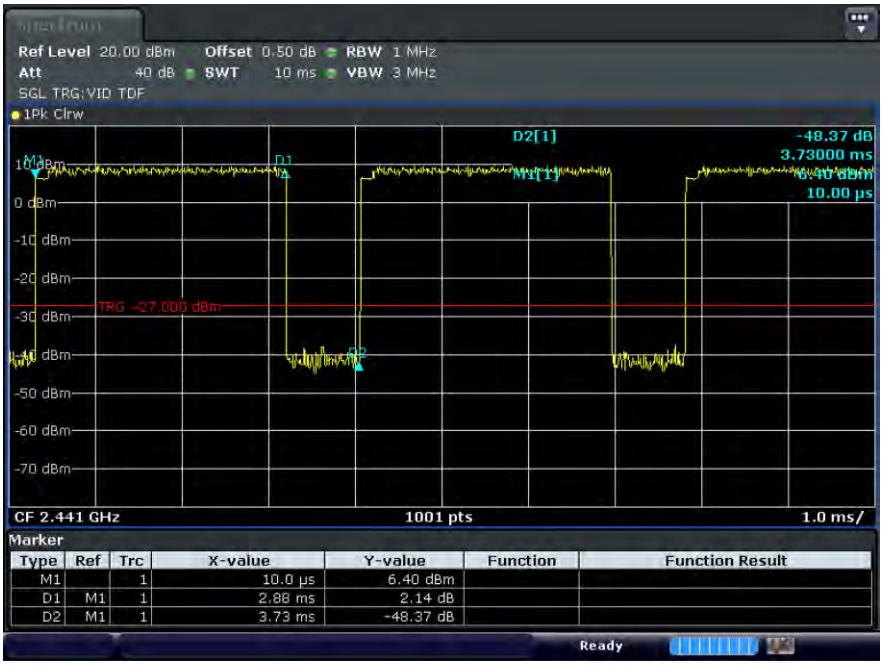
A.2. Middle Ch. (2 441 MHz)_DCCF 100 ms



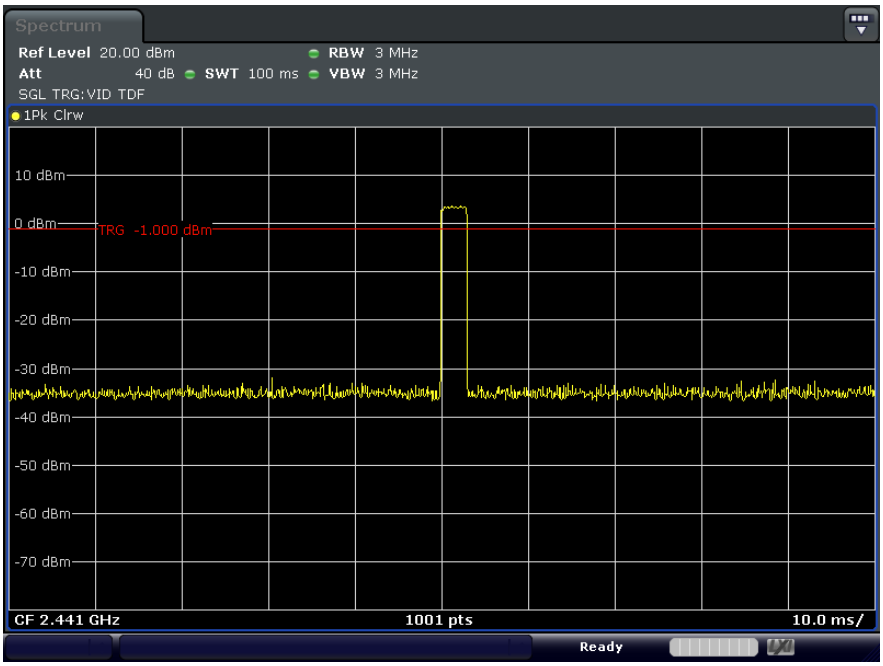
Note 1 : Worst case dwell time = Burst on time * No. of hop
Note 2 : DCCF = 20 * Log(Worst case dwell time / 100 ms) = 20 * log(2.87 / 100) = -30.84

Test mode : EDR_Right

A.1. Middle Ch. (2 441 MHz)_ Duty Cycle



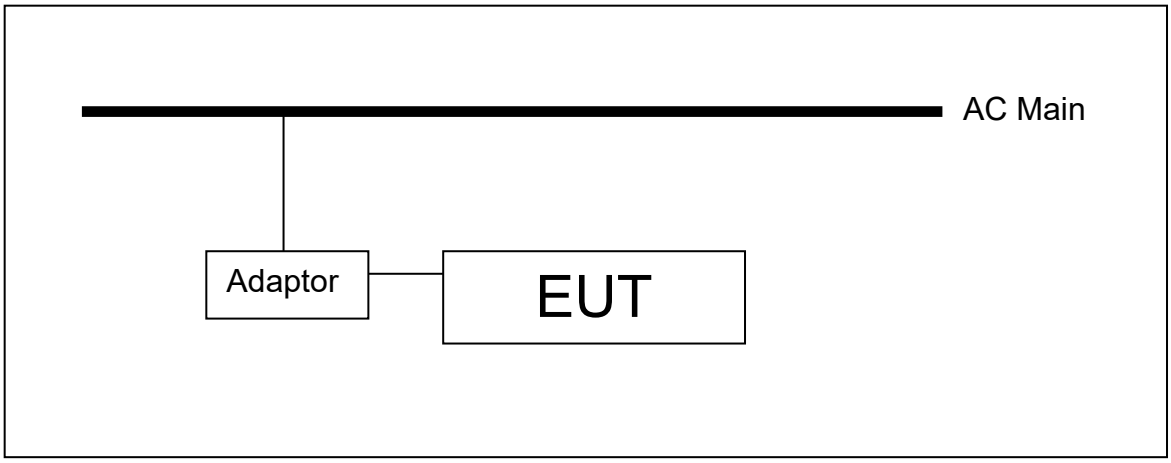
A.2. Middle Ch. (2 441 MHz)_DCCF 100 ms



Note 1 : Worst case dwell time = Burst on time * No. of hop
Note 2 : DCCF = 20 * Log(Worst case dwell time / 100 ms) = 20 * log(2.88 / 100) = -30.81

13. AC Conducted power line test

13.1. Test setup



13.2. Limit

According to §15.107(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohms line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

※Remark

Decreases with the logarithm of the frequency.

13.3. Test procedure

The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

13.4. Test results

Frequency range: 0.15 ㎒ ~ 30 ㎒
Measured bandwidth: 9 ㎑

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.17	44.03	---	64.96	20.93	7000.0	9.00	N	GND	10.19
0.17	---	30.36	54.96	24.60	7000.0	9.00	L1	GND	10.10
0.51	43.45	---	56.00	12.55	7000.0	9.00	L1	GND	10.10
0.51	---	32.89	46.00	13.11	7000.0	9.00	L1	GND	10.10
0.79	---	32.87	46.00	13.13	7000.0	9.00	L1	GND	10.12
0.79	45.63	---	56.00	10.37	7000.0	9.00	L1	GND	10.12
0.93	---	30.41	46.00	15.59	7000.0	9.00	L1	GND	10.13
0.93	43.37	---	56.00	12.63	7000.0	9.00	L1	GND	10.13
1.85	---	27.03	46.00	18.97	7000.0	9.00	L1	GND	10.19
1.86	40.50	---	56.00	15.50	7000.0	9.00	L1	GND	10.19
15.36	---	28.25	50.00	21.75	7000.0	9.00	L1	GND	11.09
15.36	40.02	---	60.00	19.98	7000.0	9.00	L1	GND	11.09

※Remark

Line(L1): Hot
Line(N): Neutral

13.4.1 Test plot