

FCC Part 15 Subpart C §15.247

Test Report

Equipment Under Test	D&E OFFICIAL LIGHT STICK
Model Name	ODE-D&E-OLS01
Variant Model Name	-
FCC ID	QDM-ODE-DE-OLS
IC Number	-
Applicant	DREAMUS COMPANY
Manufacturer	DREAMUS COMPANY
Date of Test(s)	2024. 11. 12 ~ 2024. 11. 20
Date of Issue	2024. 11. 26

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
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Issue to	Issue by
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Revision history

Revision	Date of issue	Description	Revised by
--	2024.11.26	Initial	-
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1. Applicant Information

1.1. Details of applicant

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1.2. Manufacturer Information

Manufacturer : DREAMUS COMPANY
Address : 311, Gangnam-daero, Seocho-gu, Seoul, Republic of Korea

2. Laboratory Information

Company name : DEKRA Korea Co., Ltd.
Test site number : FCC (KR0151)
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3. Summary of test results

The EUT has been tested according to the following specifications:

FCC Rule FCC part 15	Description	Result
15.203 15.247(b)(4)	Antenna requirement	C
15.247(a)(2)	DTS Bandwidth & 99 % bandwidth	C
15.247(b)(3)	Maximum peak conducted output power	C
15.247(e)	Peak Power Spectral Density	C
15.205(a) 15.209(a) 15.247(d)	Transmitter radiated spurious emissions, Conducted spurious emission	C
15.207(a)	AC Conducted power line test	N/A

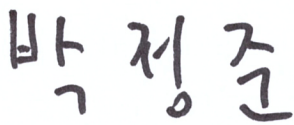
※ Abbreviation

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 C63.10:2020
FCC Public Notice KDB 558074 D01 v05r02

Approval Signatories

Test and Report Completed by :	Report Approval by :
	
Len Park Test Engineer DEKRA Korea Co., Ltd.	Kin Son Technical Manager DEKRA Korea Co., Ltd.

The above test certificate is a test report not related to the Korean Laboratory Accreditation Scheme

4. EUT Description

Kind of product	Light Stick
Model Name	ODE-D&E-OLS01
Variant Model Name	-
FCC ID	QDM-ODE-DE-OLS
IC Number	-
Power supply	USB-C : DC 5.00 V Battery : DC 4.50 V
Frequency range	2 402 MHz ~ 2 480 MHz
Modulation technique	GFSK
Number of channels	40 ch
Antenna gain / Type	0.37 dBi / PCB Antenna
Test Site Registration Number	FCC (KR0151)
H/W version / S/W version	1.0 / 1.0
Test S/W version	abd 1.0.2.2

4.1. Table for Test Modes and Frequency

The following table is a list of the test modes shown in this test report.

Mode	Data rate	Frequency (Freq. MHz)
Bluetooth LE	1 Mbps	Lowest (2 402) / Middle (2 440) / Highest (2 480)

5. Measurement equipment

Equipment	Manufacturer	Model	Serial number	Calibration Interval	Calibration date	Calibration due.
Test Receiver	R&S	ESW44	103182	1 year	2024-08-29	2025-08-29
Signal Generator	R&S	SMB100A	178128	1 year	2024-05-17	2025-05-17
Spectrum Analyzer	R&S	FSVA40	101591	1 year	2024-03-15	2025-03-15
DC Power Supply	Agilent	U8002A	MY56110033	1 year	2024-05-17	2025-05-17
Horn Antenna	R&S	HF906	100236	2 year	2023-06-11	2025-06-11
Horn Antenna	R&S	SAS-572	270	1 year	2024-05-16	2025-05-16
Bi-Log Ant.	SCHWARZBECK	VULB9161SE	4159	2 year	2024-03-21	2026-03-21
Loop Antenna	ETS LINDGREN	6502	00118166	2 year	2024-05-16	2026-05-16
Amplifier	SONOMA	SONOMA 310N	186486	1 year	2024-11-05	2025-11-05
Pre Amplifier	COM-POWER	PAM-840A	18050014	1 year	2024-05-20	2025-05-20
Low Noise Amplifier	TESTEK	TK-PA18H	170013-L	1 year	2024-05-13	2025-05-13
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	2024-09-23	2024-12-23
RF Cable	SUHNER	SUCOFLEX102	801270/2	3 month	2024-09-23	2024-12-23
RF Cable	SUHNER	SUCOFLEX102	801532/2	3 month	2024-09-23	2024-12-23

※Remark

Support equipment

Description	Manufacturer	Model	Serial number
Notebook computer	DELL	E5440	8HCMN12

6. Antenna Requirement

6.1. Standard applicable

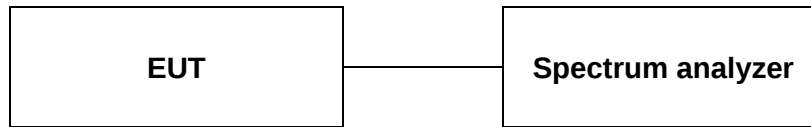
For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247 (c) if transmitting antennas of directional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

6.2. Antenna connected construction

Antenna used in this product is PCB antenna,
Antenna gain is 0.37 dBi.

7. DTS bandwidth & 99% bandwidth measurement

7.1. Test setup



7.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902~928 MHz, 2 400~2 483.5 MHz, and 5 725~5 825 MHz bands. The minimum of 6 dB Bandwidth shall be at least 500 kHz

7.3. Test procedure

DTS bandwidth & 99% bandwidth is measured using the following procedure

1. Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz
2. Set the VBW $\geq 3 \times$ RBW.
3. Detector = peak
4. Trace mode = max hold
5. Sweep time = No faster than coupled(auto) time.
6. Allow trace to fully stabilize
7. Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "-6 dB down amplitude". If a marker is below this "-6 dB down amplitude" value, then it shall be as close as possible to this value.

7.4. Test results

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

Frequency(MHz)	6 dB bandwidth(MHz)	99% bandwidth(MHz)
2 402	0.77	1.17
2 440	0.77	1.17
2 480	0.78	1.18

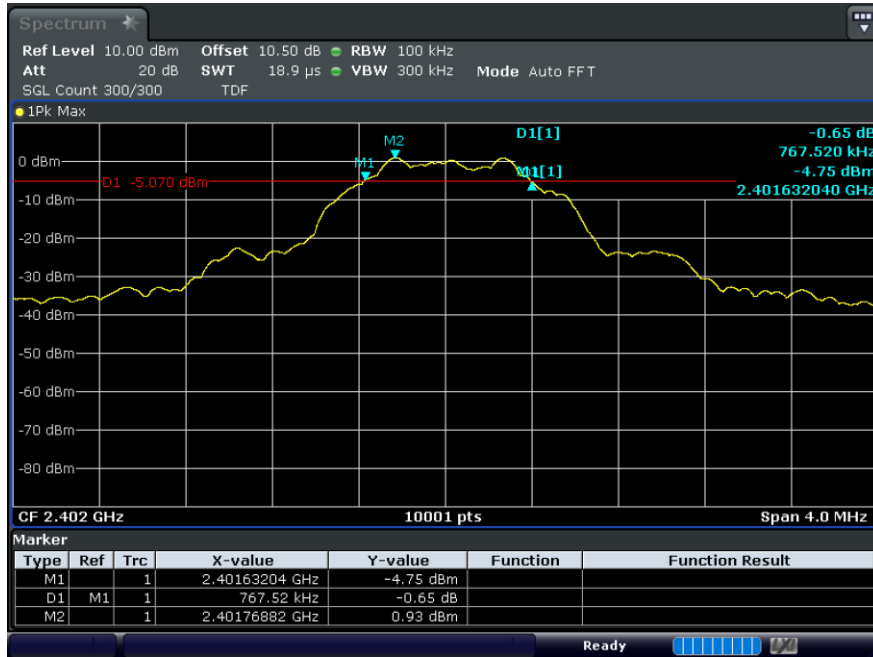
※Remark

1. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

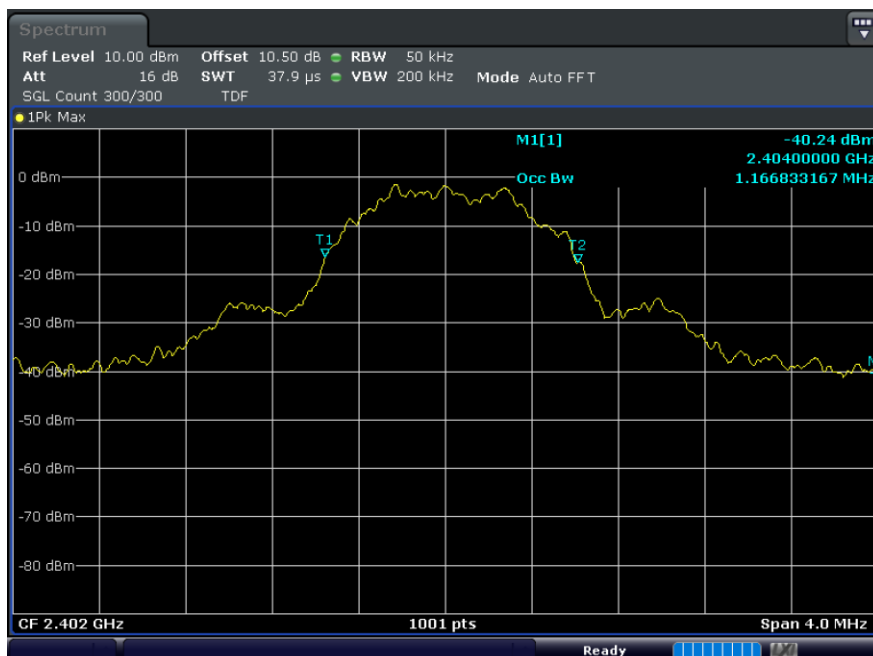
7.4.1. Test plot

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

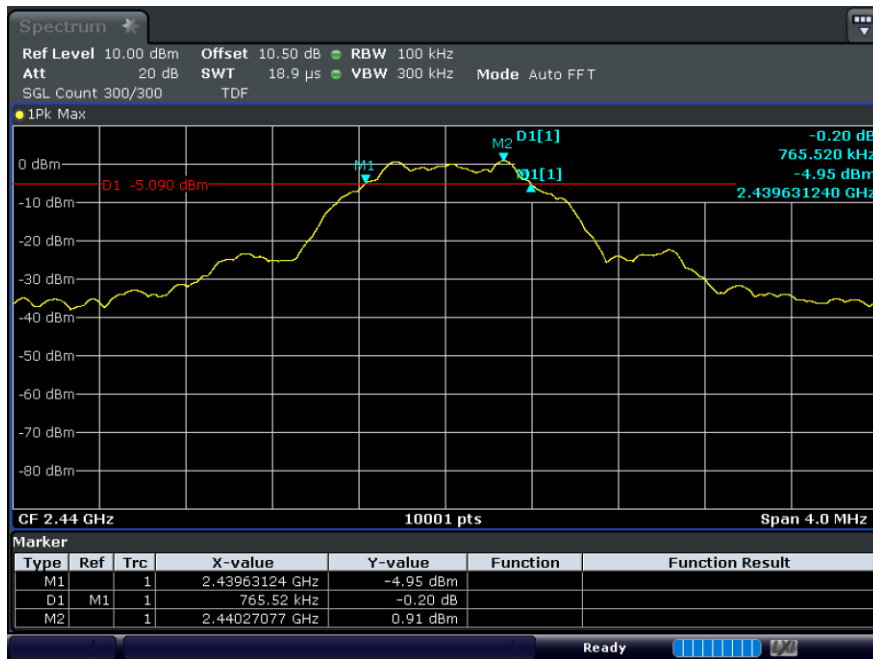
A.1. Lowest Ch. (2 402 MHz)_6dB Bandwidth



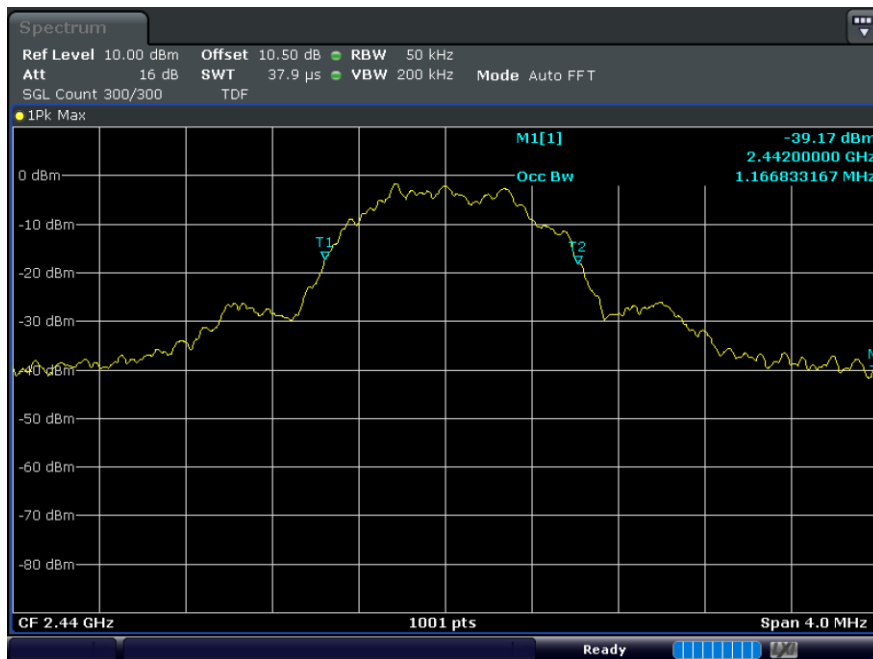
A.2. Lowest Ch. (2 402 MHz)_99% Bandwidth



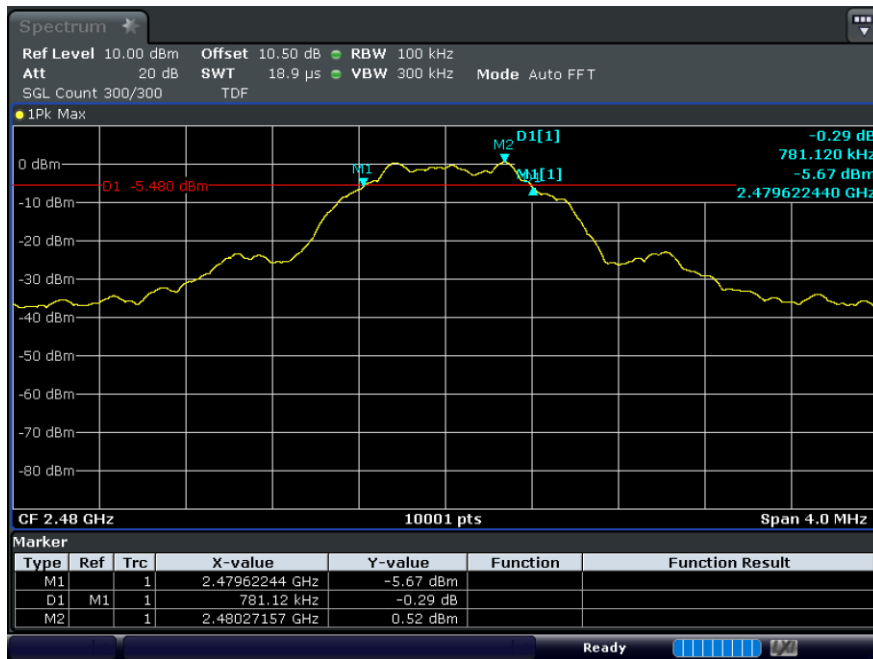
B.1. Middle Ch. (2 440 MHz)_6dB Bandwidth



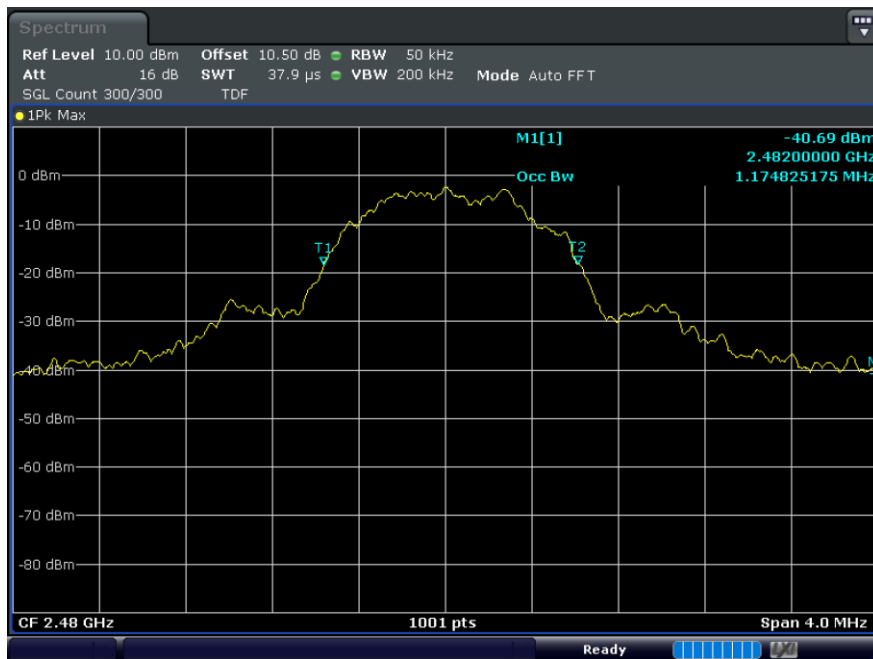
B.2. Middle Ch. (2 440 MHz)_99% Bandwidth



C.1. Highest Ch. (2 480 MHz)_6dB Bandwidth

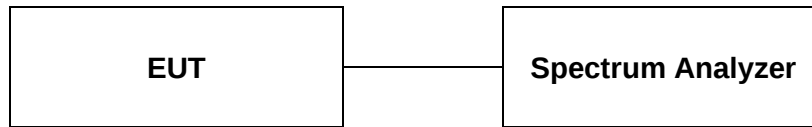


C.2. Highest Ch. (2 480 MHz)_99% Bandwidth



8. Maximum peak conducted 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 kHz or the 6 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW
2. §15.247(b)(1), For frequency hopping systems operating in the 2400–2483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5805 MHz band: 1Watt.

8.3. Test procedure

Maximum Peak Conducted Output Power is measured using the following procedure (RBW $\geq$ DTS bandwidth).

1. Set the RBW $\geq$ DTS bandwidth.
2. Set VBW $\geq 3 \times$ RBW.
3. Set Span $\geq 3 \times$ RBW.
4. Sweep time = No faster than coupled(auto) time.
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

8.4. Test results

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

Frequency(MHz)	Conducted power (dBm)	Limit (dBm)
2 402	1.78	30.00
2 440	1.62	
2 480	1.25	

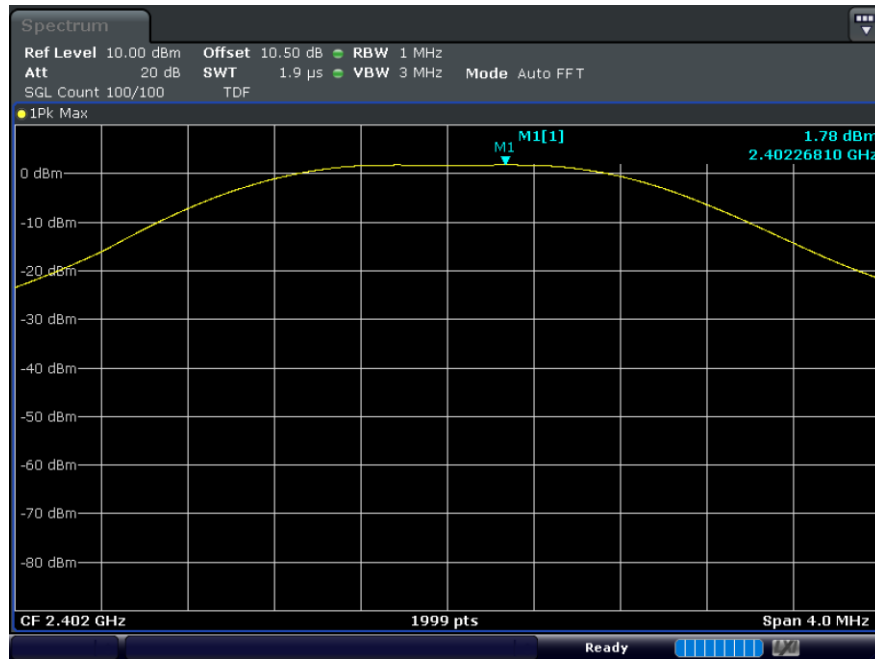
※Remark

1. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

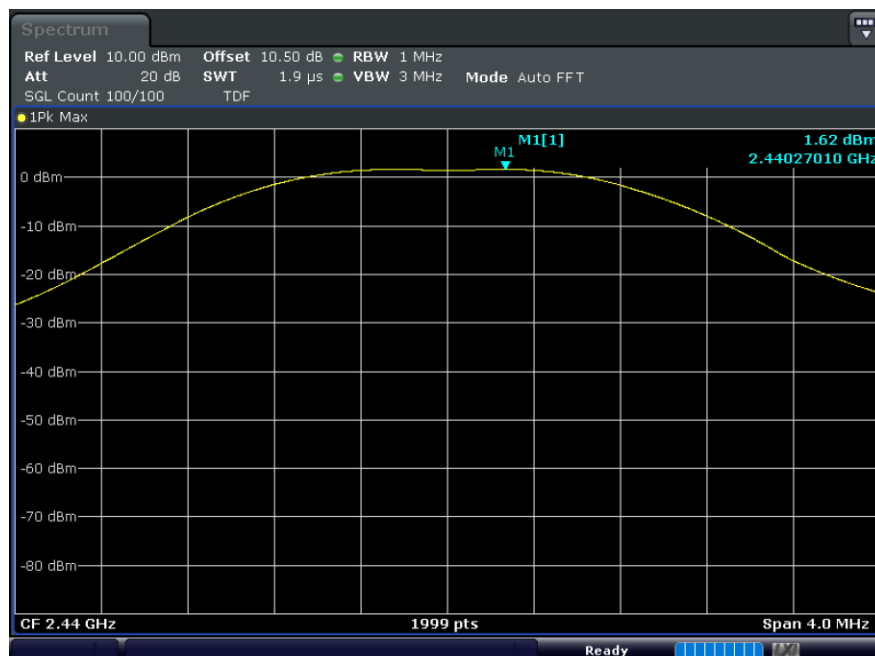
8.4.1. Test plot

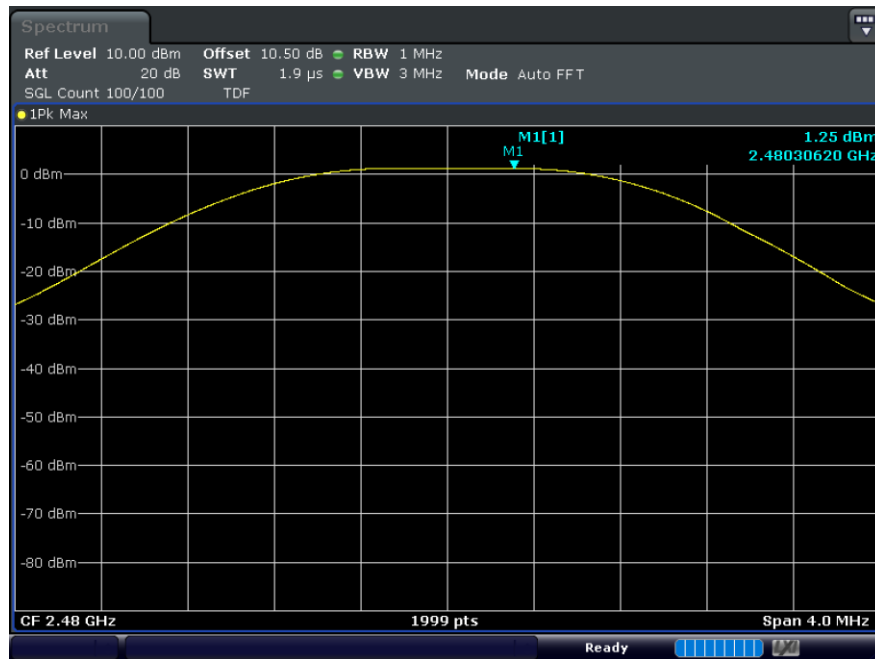
Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

A. Lowest Ch. (2 402 MHz)



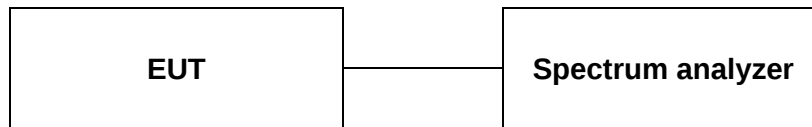
B. Middle Ch. (2 440 MHz)



C. Highest Ch. (2 480 MHz)

9. Peak power spectral density

9.1. Test setup



9.2. Limit

< 8 dBm @ 3 kHz BW

9.3. Test procedure (PKPSD)

Peak power spectral density is measured using the following procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the Span > 1.5 times the DTS bandwidth.
3. Set the $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$
4. Set the $\geq 3 \times RBW$
5. Detector = peak
6. Trace mode = Max hold
7. Allow trace to fully stabilize
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

9.4. Test results

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

Frequency(MHz)	Power spectral density(dBm)	Limit (dBm)
2 402	-13.97	8.00
2 440	-14.11	
2 480	-14.49	

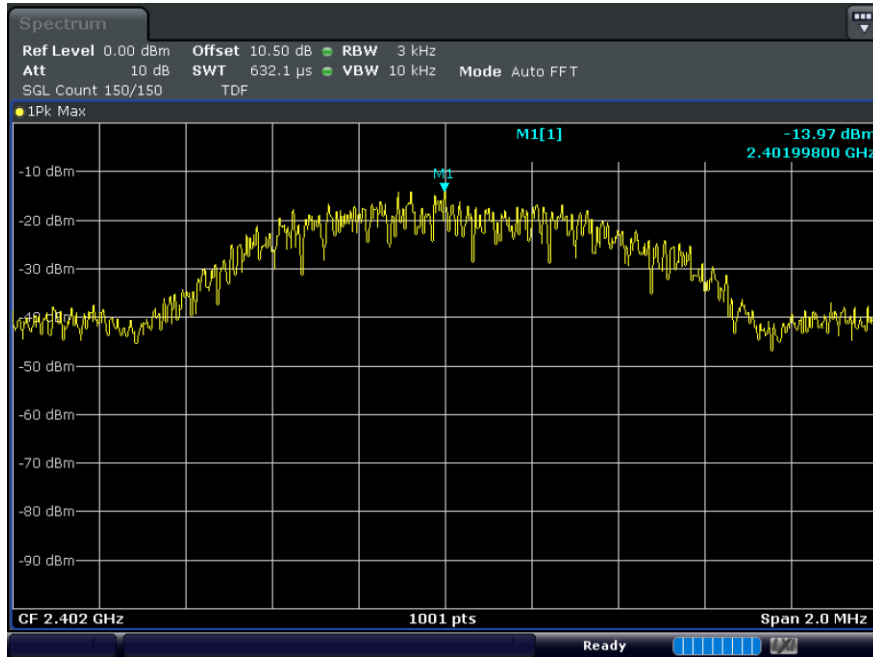
※Remark

1. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

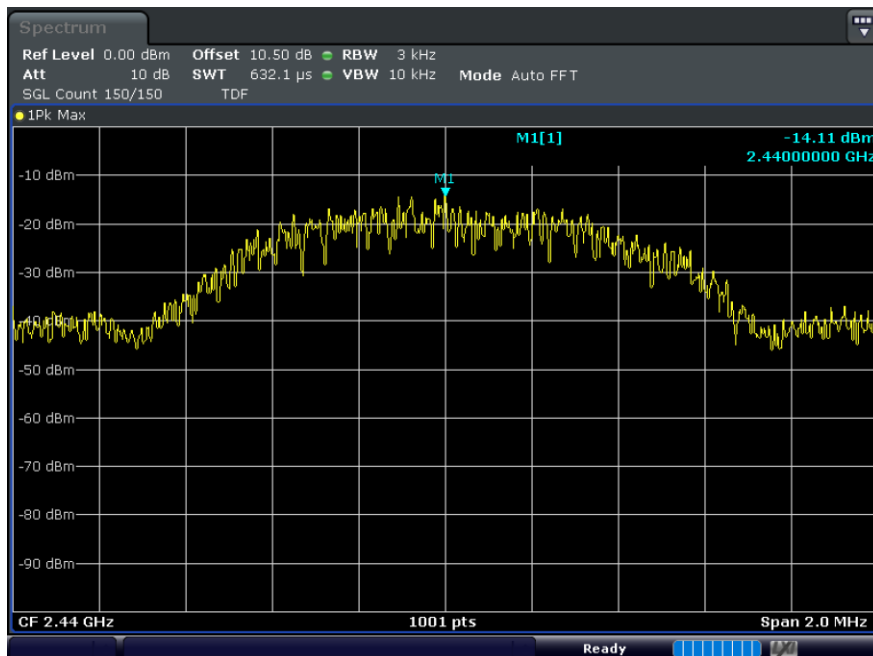
9.4.1. Test plot

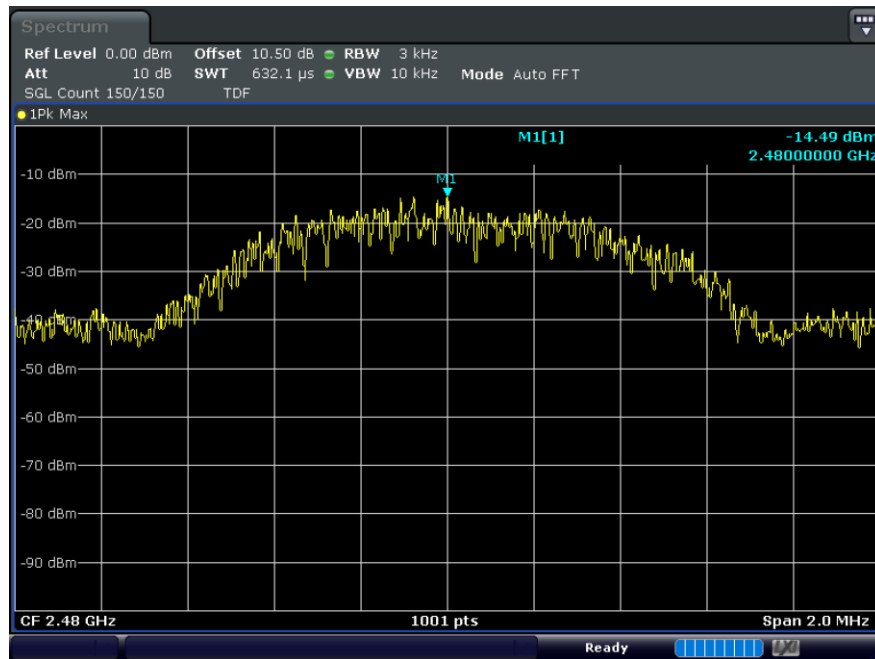
Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

A. Lowest Ch. (2 402 MHz)



B. Middle Ch. (2 440 MHz)



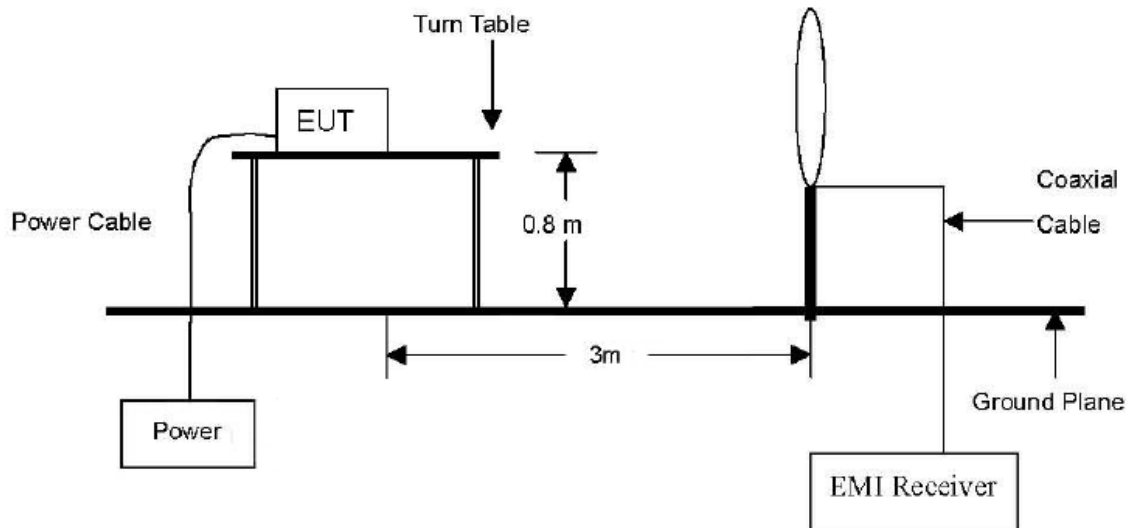
C. Highest Ch. (2 480 MHz)

10. Transmitter radiated spurious emissions and conducted spurious emissions

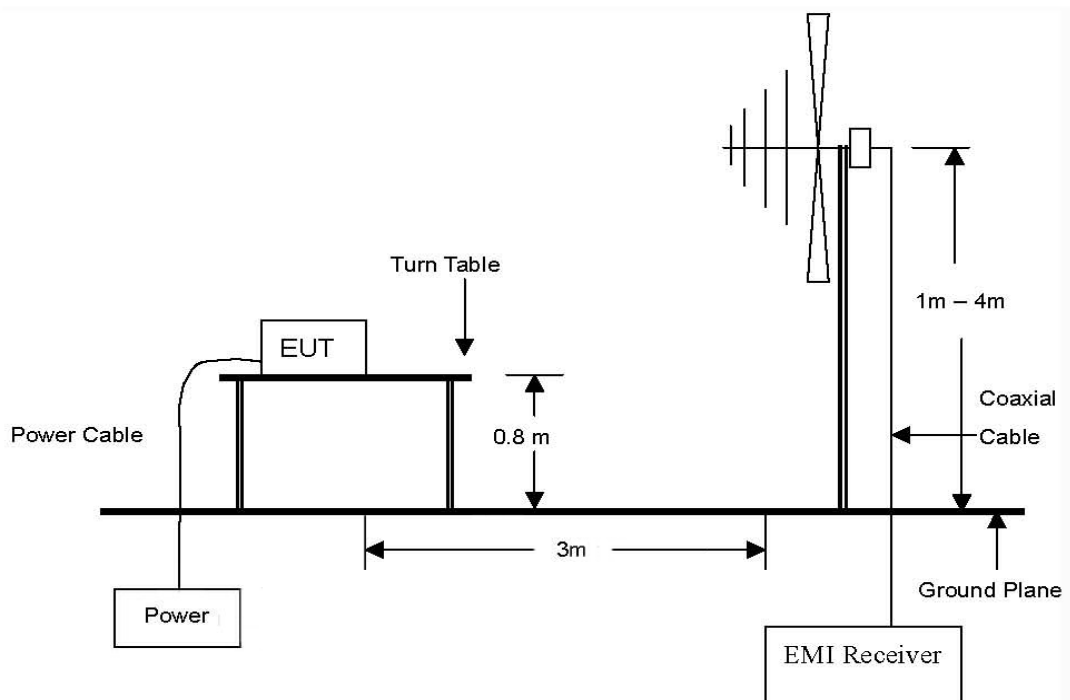
10.1. Test setup

10.1.1. Transmitter radiated spurious emissions

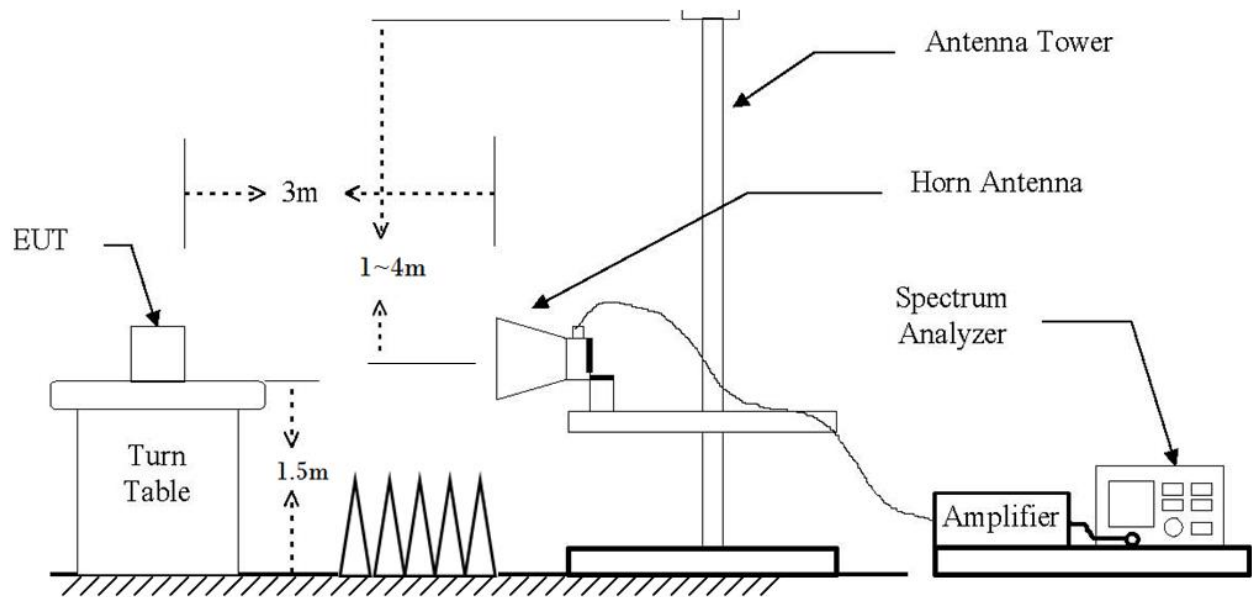
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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



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



10.2. Limit

According to §15.247(d), 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. 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 dB instead of 20 dB. 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 (MHz)	Distance (Meters)	Radiated at 3M (dBuV/m)	Radiated (uV/m)
0.009–0.490	300	See the remark	2400/F(kHz)
0.490–1.705	30		24000/F(kHz)
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 dBuV/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)(dB)
Limit line=Specific limits(dBuV) + distance extrapolation factor.

10.3. Test procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10:2020. 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.

10.3.1. Test procedures for radiated spurious emissions

1. The EUT is placed on a turntable, which is 0.8 m (Below 1 GHz)/ 1.5 m (Above 1GHz) 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 kHz for Peak detection (PK) at frequency below 30 MHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

10.3.2. 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 kHz, VBW=100 kHz.

10.4. Test results

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

The frequency spectrum from 9 kHz to 30 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB. 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 : Bluetooth LE (1 Mbps)_2 480 MHz (Worst Case : Battery 4.50 V)

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. Actual = 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.

3. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

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

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB. 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 : Bluetooth LE (1 Mbps)_2 480 MHz (Worst Case : Battery 4.50 V)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
43.07	QP	V	31.41	40.00	8.59
50.99	QP	V	29.56	40.00	10.44
115.38	QP	H	27.58	43.52	15.94
213.60	QP	H	27.45	43.52	16.07
739.51	QP	H	36.73	46.02	9.29
Above 800 MHz Not detected					

※Remark

1. Actual = 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.

3. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

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

The frequency spectrum above 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

A. Lowest Ch. (2 402 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 389.87	Peak	H	48.70	74.00	25.30
*4 804.87	Average	H	47.29	74.00	26.71
Above 5 000 MHz Not detected					

B. Middle Ch. (2 440 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*4 880.69	Average	H	44.71	74.00	29.29
Above 6 000 MHz Not detected					

※Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Actual = 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) = $20 \times \log(\text{Worst case dwell time} / 100 \text{ ms})$ dB
7. Average measurement did not take place because the peak data did not exceed average limit
8. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

C. Highest Ch. (2 480 MHz)

Frequency (MHz)	Detector Mode	Pol.	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2 483.50	Average	V	28.87	74.00	45.13
*4 959.60	Peak	H	50.42	74.00	23.58
Above 6 000 MHz Not detected					

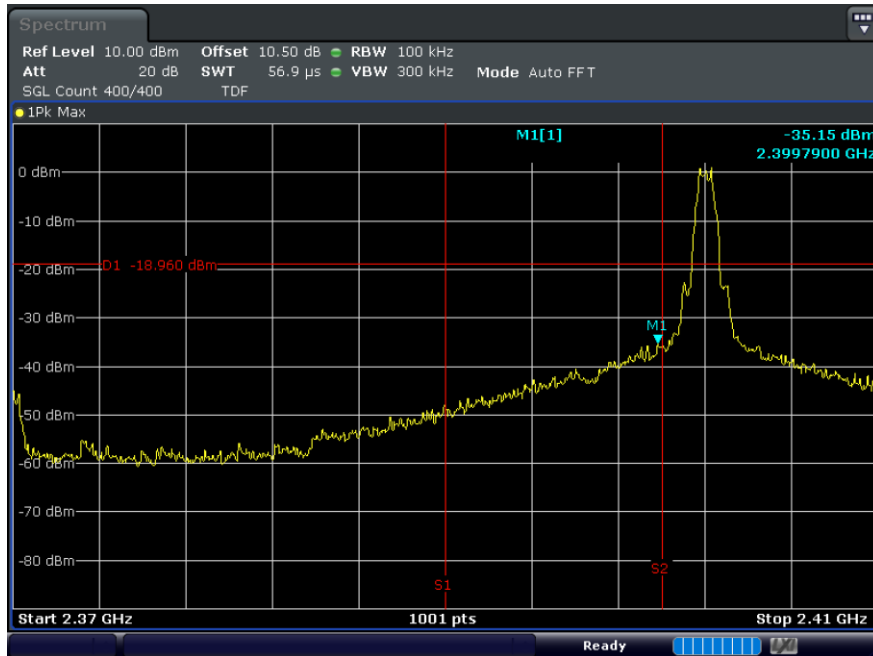
※Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Actual = 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) = $20 \times \log(\text{Worst case dwell time} / 100 \text{ ms}) \text{ dB}$
7. Average measurement did not take place because the peak data did not exceed average limit
8. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

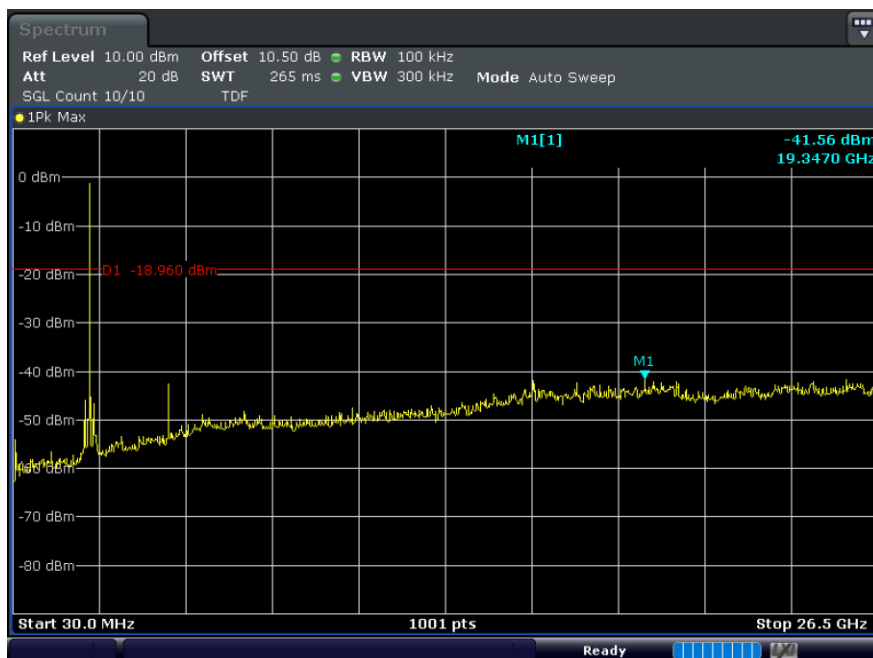
10.4.4. Test plot (Conducted spurious emissions & Bandedge)

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

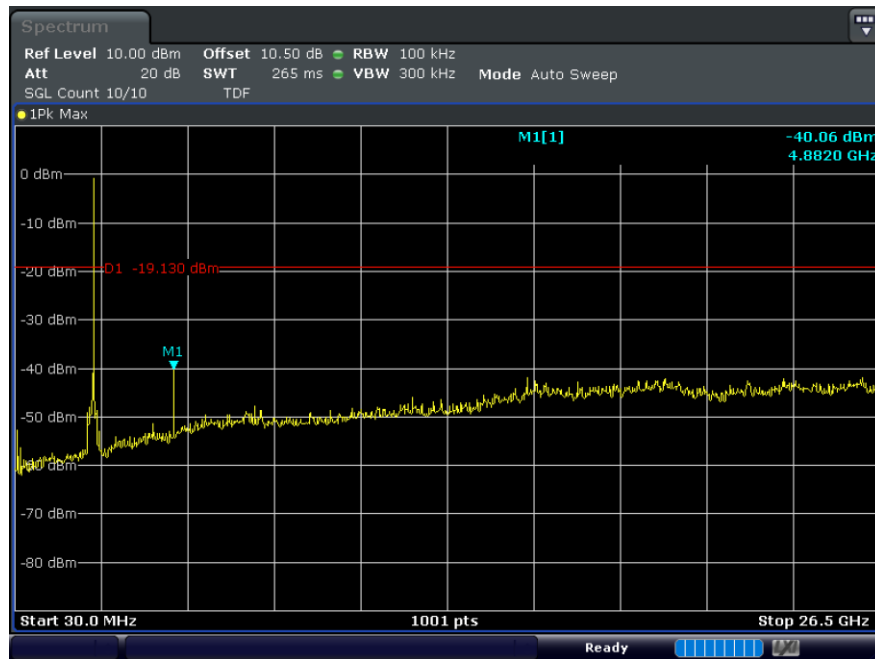
A.1. Lowest Ch. (2 402 MHz)_Band edge



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

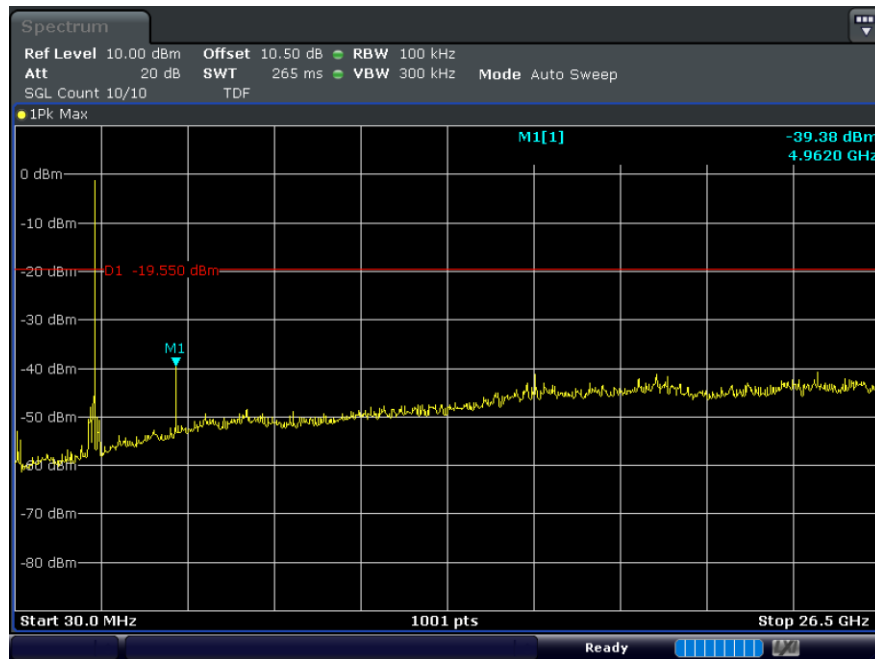


B.1. Middle Ch. (2 440 MHz)_Spurious emissions



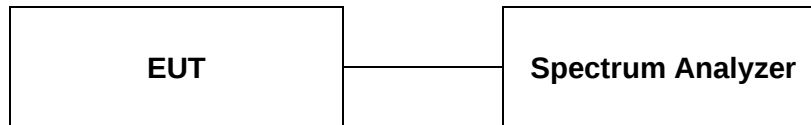
C.1. Highest Ch. (2 480 MHz)_ Band edge



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

11. Duty Cycle

11.1. Test setup



11.2. Limit

According to ANSI C63-10 paragraph 6.3.2 Operational Configurations a), set the unlicensed wireless device to operate in continuous transmit mode. For unlicensed wireless devices unable to be configured for 100% duty cycle even in test mode, configure the system for the maximum duty cycle supported.

11.3. Test procedure

Duty cycle is measured using the following procedure.

1. Span = Zero span, centered on a middle channel.
2. RBW 1 MHz, VBW 3 MHz
3. Sweep time = Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured.
4. Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed.
5. Detector = peak
6. Trace mode = Clear write, single sweep.
7. Place markers at the start of the first transmission on the channel and at the end of the last transmission. The dwell time per hop is the time between these two markers.

11.4. Test results

Test mode : Bluetooth LE (1 Mbps) (Worst Case : Battery 4.50 V)

On Time [ms]	Off Time [ms]	Duty Cycle [%]
0.392	0.626	62.6

※Remark

1. The transmitter testing was completed with the transmitter operating at maximum operational mode (maximum possible data length of Bluetooth LE 1 Mbps: 37 bytes)
2. These results are satisfied in accordance with decision rules, including measurements and estimates of measurement uncertainty

11.5. Test plot

