

FCC Part 15 EMI TEST REPORT

of



E.U.T. : Miko Drip
Model No. : MK-D1010
Serial Model : MK-D1000 、 MK-D1020
FCC ID : 2A24QMKD1010

for

APPLICANT : Mikotek Information Inc.
ADDRESS : 3F., No.20, Aly. 18, Ln. 478, Ruiguang
Rd., Neihu Dist., Taipei City 114.

Test Performed by

Taiwan Testing and Certification Center

No.34, Dingfu, Linkou Dist., New Taipei City 244, Taiwan (R.O.C.)

Tel:(02)26023052 Fax:(02)26010910

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Report Number :19-10-RBF-021-03

TEST REPORT CERTIFICATION

Applicant : Mikotek Information Inc.
3F., No.20, Aly. 18, Ln. 478, Ruiguang Rd., Neihu Dist., Taipei City 114.

Manufacture : Mikotek Information Inc.
3F., No.20, Aly. 18, Ln. 478, Ruiguang Rd., Neihu Dist., Taipei City 114.

Description of Device :

- a) Type of EUT : Miko Drip
- b) Trade Name : MIKO
- c) Model No. : MK-D1010
- d) Serial Model : MK-D1000 、 MK-D1020
- e) Power Supply : DC 3 V
- f) Frequency Range : 2402-2480MHz

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2013, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.

2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Summary of Tests

Test	Results
Radiated Emission	Pass
Conducted Emission	N/A
Emission Bandwidth	Pass
Output Power	Pass
100 kHz Bandwidth of Band Edges	Pass
Power Density	Pass
Out-of-Band Conducted Emission	Pass
Duty Cycle	N/A

Date Test Item Received : 10/22/2019

Date Test Campaign Completed : 6/25/2020

Date of Issue : 9/16/2021

Test Engineer

:

Kazuma Ho

(Kazuma Ho, Engineer)

Approve & Authorized

:

Vincent Chang

Vincent Chang, Supervisor
EMC Dept. II

Taiwan Testing and Certification
Center



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1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : Miko Drip
b) Trade Name : MIKO
c) Model No. : MK-D1010
d) Serial Model : MK-D1000 、 MK-D1020
e) Working Frequency : 2402-2480MHz
f) Power Supply : DC 3 V

1.2 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.10-2013. Other required measurements were illustrated in separate sections of this test report for details.

Measurement Software

Software	Version	Note
e3	Version 6.100618f	Radiated Emission Test
e3	Version 6.100421	Conducted Emission Test

1.3 Test Facility

Location of the Test site: No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.

Designation Number: TW2628.

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

Except as shown in paragraphs (b) and (c) of this section, 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 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency MHz	Quasi Peak dB μ V	Average dB μ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limits is same as above table.

(2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the 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 dB μ V/m	Radiated μ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

(3) Antenna Requirement

For intentional device, according to §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.

(4) Hopping Channel Separation

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

(5) Number of Hopping frequencies used

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

(6) Hopping Channel Bandwidth

For frequency hopping system operating in the 2400–2483.5 MHz band, there is no requirement for the maximum 20dB bandwidth of the hopping channel. The measurement of the hopping channel bandwidth is for the reference of the hopping channel separation requirement.

(7) Dwell Time of each frequency

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2400-2483.5 band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

(8) Output Power Requirement

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

(9) 100 kHz Bandwidth of Frequency Band Edges Requirement

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 §15.209(a) is not required.

(10) Out-of-Band Conducted Emission Requirement

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 §15.209(a) is not required.

2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

For both radiated and conducted emissions below 1 GHz, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Measurement was performed under the condition that a computer program was exercised to simulate data communication of EUT, and the transmission rate was set to maximum allowed by EUT. Three highest emissions were verified with varying placement of the transmitting antenna connected to EUT (if applicable) to maximize the emission from EUT.

For conducted and radiated emissions, whichever RF channel is operated, the digital circuits' function identically. As the reason, measurement of emissions from digital circuits is performed with the highest, middle and the lowest channel by transmitting mode.

The following modes were investigated and the worst cases (mode 1) were chosen for final test.

1. Bluetooth Low Energy (Bluetooth LE) Data Rate 1 Mbps uses GFSK modulation

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
Miko Drip*	Mikotek Information Inc.	MK-D1010/2A24QMK D1010	--
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Remark “*” means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

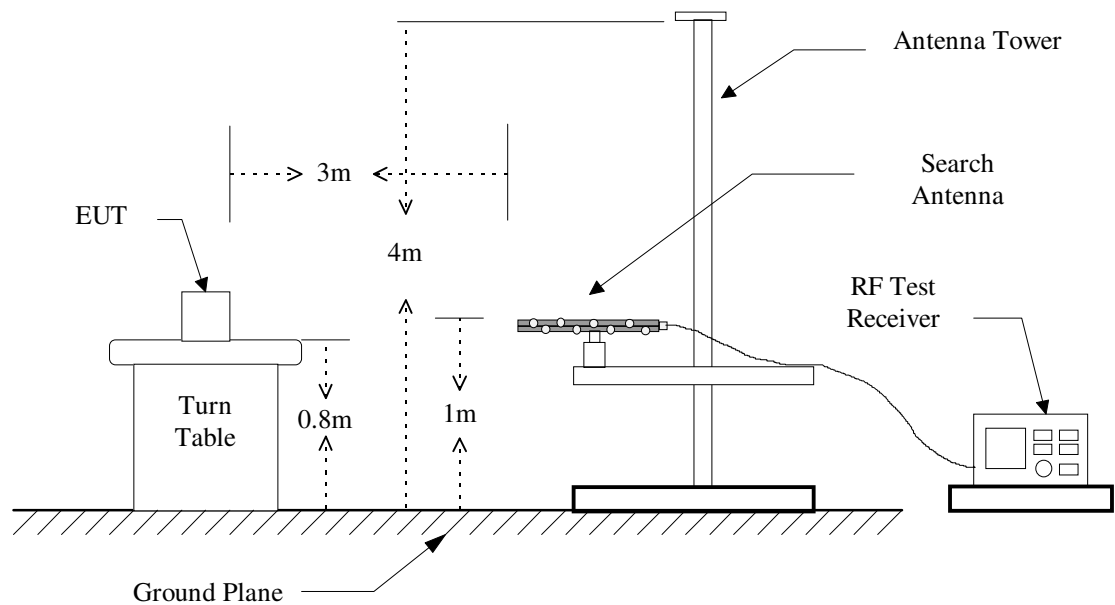
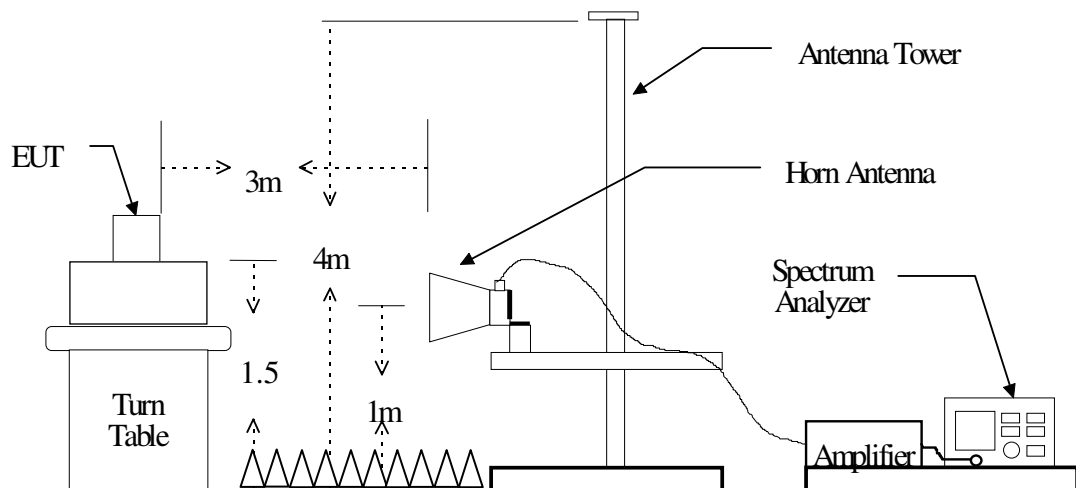


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESU 40 (4013054416-001)	2021/03/25	2022/03/24
Bi-Log Antenna	ETC & JYEBAO	MCTD 2786 & FAT-NM5NF5T3G2 W6	2020/07/31	2021/07/30
Amplifier	HP	8447D (13040711-001)	2020/10/06	2021/10/05
Horn Antenna (1-18G)	ETS-Lindgren	3117	2021/03/16	2022/03/15
Amplifier (1G-18G)	HP	8449B	2020/10/06	2021/10/05
Horn Antenna (18-40G)	EMCO	3116	2020/08/19	2021/08/18
Amplifier (1G-40G)	Keysight	83051A	2020/08/27	2021/08/26

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz or $\geq 1/T$ (Note 1)

Note 1:

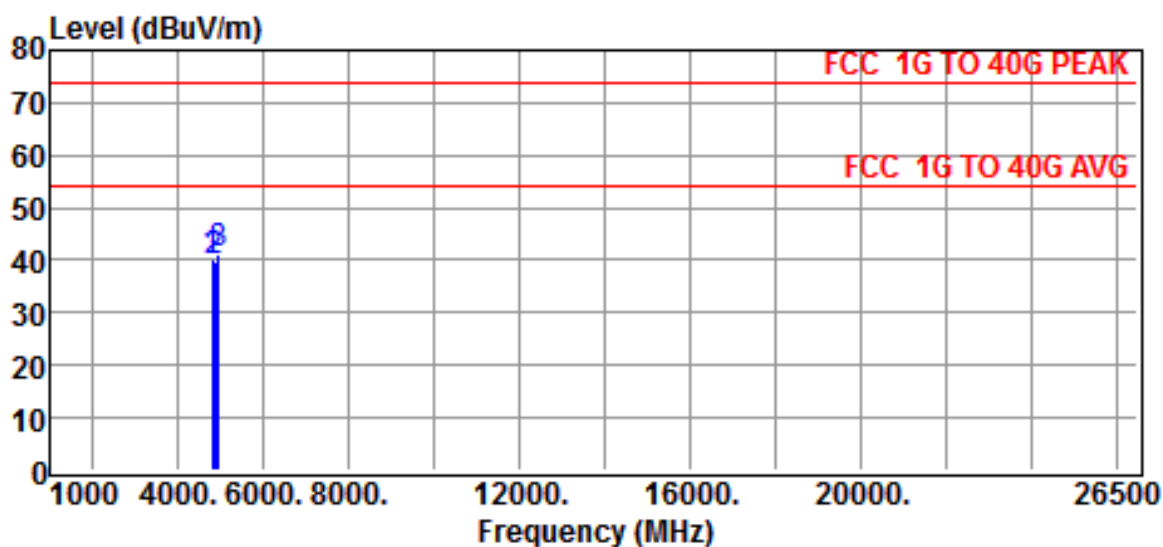
VBW = 10 Hz, when the duty cycle is no less than 98%.

VBW $\geq 1/T$, when duty cycle is less than 98% where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

4.4 Radiated Emission Data

4.4.1 Tx Portion

A. Bluetooth BLE

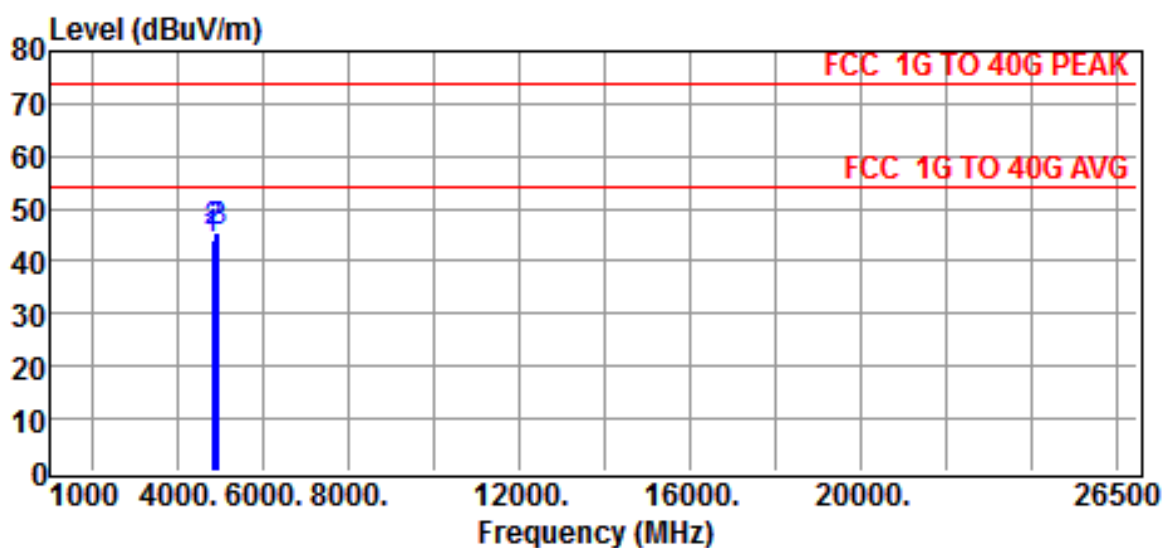


Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:HORIZONTAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:BLE		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	4804.0000	35.75	4.68	40.43	74.00	-33.57	Peak
	4880.0000	35.13	4.80	39.93	74.00	-34.07	Peak
*	4960.0000	36.08	4.90	40.98	74.00	-33.02	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.



Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:VERTICAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:BLE		

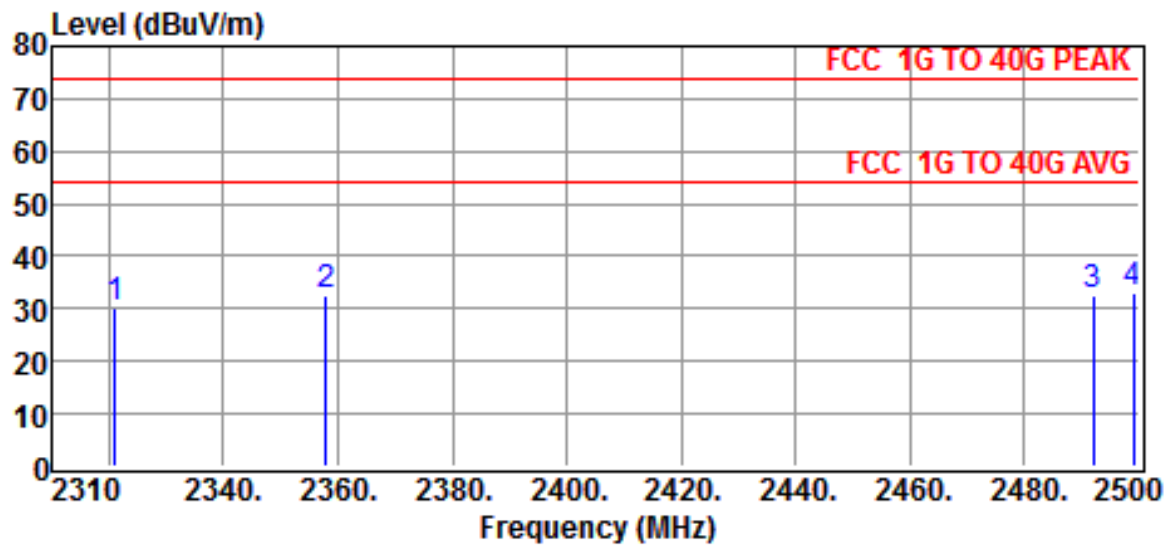
	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	4804.0000	39.43	4.68	44.11	74.00	-29.89	Peak
	4880.0000	40.74	4.80	45.54	74.00	-28.46	Peak
*	4960.0000	40.72	4.90	45.62	74.00	-28.38	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.

4.4.2 Radiated Emissions in Restricted Bands

A. Bluetooth BLE

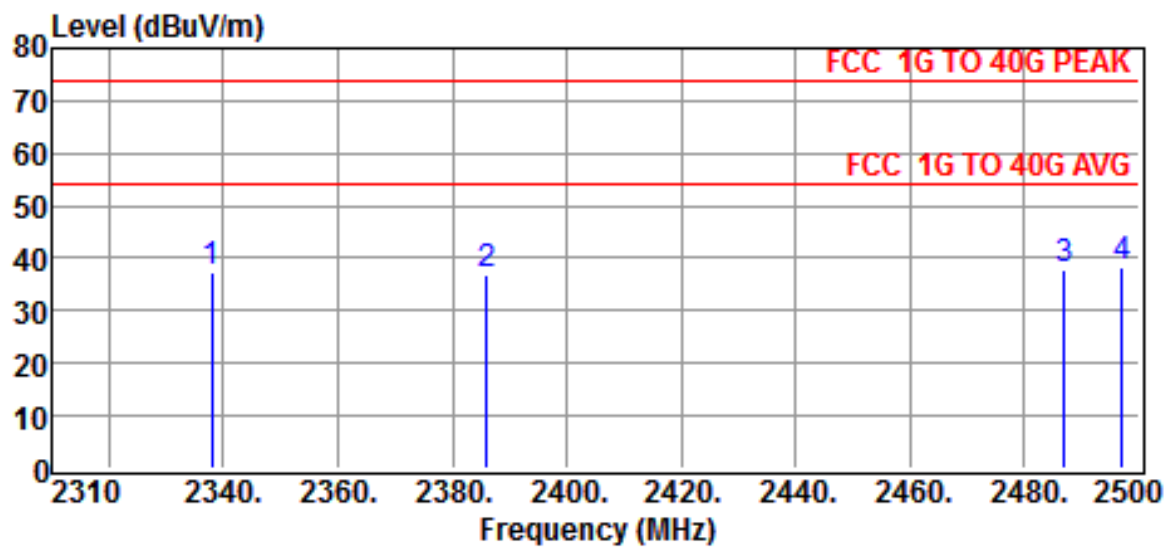


Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:HORIZONTAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:BLE		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	2321.0000	30.60	-0.37	30.23	74.00	-43.77	Peak
	2358.0000	32.57	-0.16	32.41	74.00	-41.59	Peak
	2492.0000	32.51	-0.05	32.46	74.00	-41.54	Peak
*	2499.0000	33.04	-0.02	33.02	74.00	-40.98	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.



Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:VERTICAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:BLE		

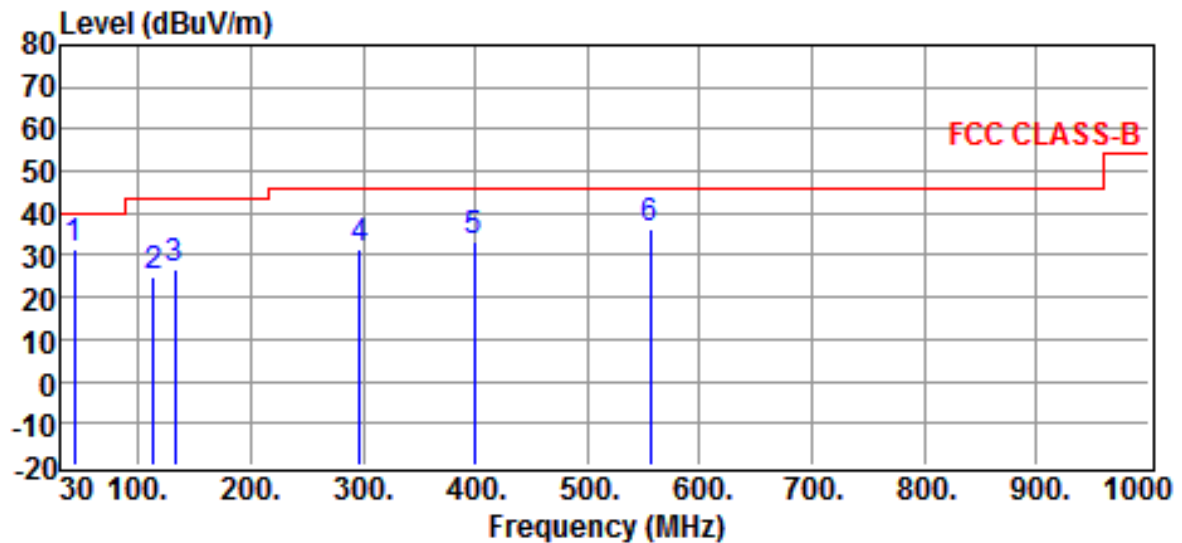
	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	2338.0000	37.54	-0.24	37.30	74.00	-36.70	Peak
	2386.0000	36.91	-0.17	36.74	74.00	-37.26	Peak
	2487.0000	38.09	-0.07	38.02	74.00	-35.98	Peak
*	2497.0000	38.39	-0.03	38.36	74.00	-35.64	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.

4.4.3 Other Emissions

a) Emission frequencies below 1 GHz

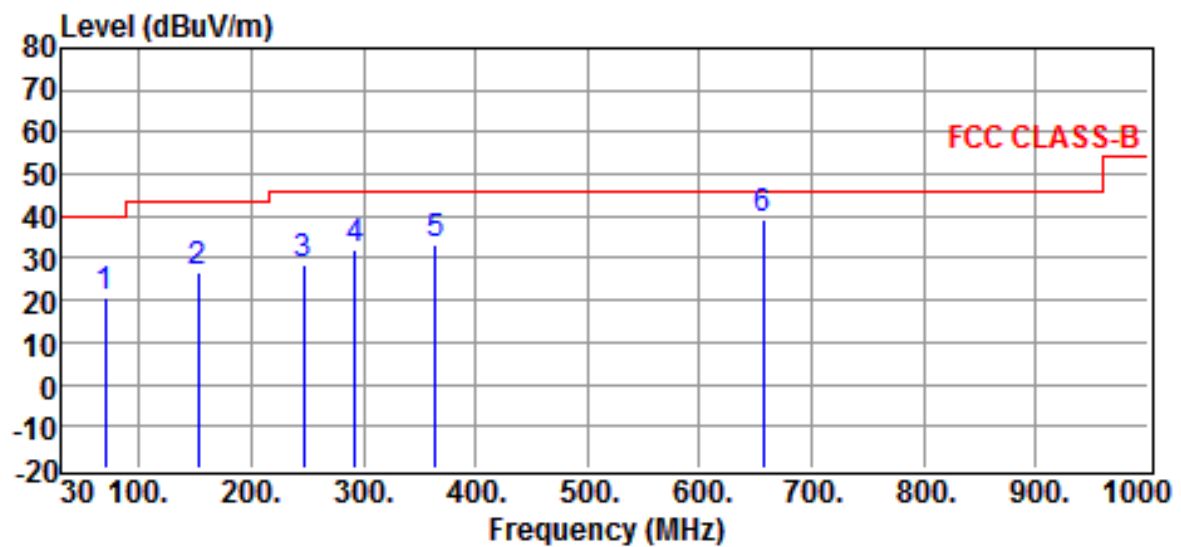


Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC CLASS-B	Ant. Pol.	:HORIZONTAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:Mode 1-Operation		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
*	42.8800	38.96	-7.68	31.28	40.00	-8.72	QP
	113.1800	33.41	-8.54	24.87	43.50	-18.63	QP
	132.5900	33.95	-7.27	26.68	43.50	-16.82	QP
	296.9600	34.73	-3.18	31.55	46.00	-14.45	QP
	399.3700	34.18	-1.13	33.05	46.00	-12.95	QP
	555.4600	34.67	1.43	36.10	46.00	-9.90	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.



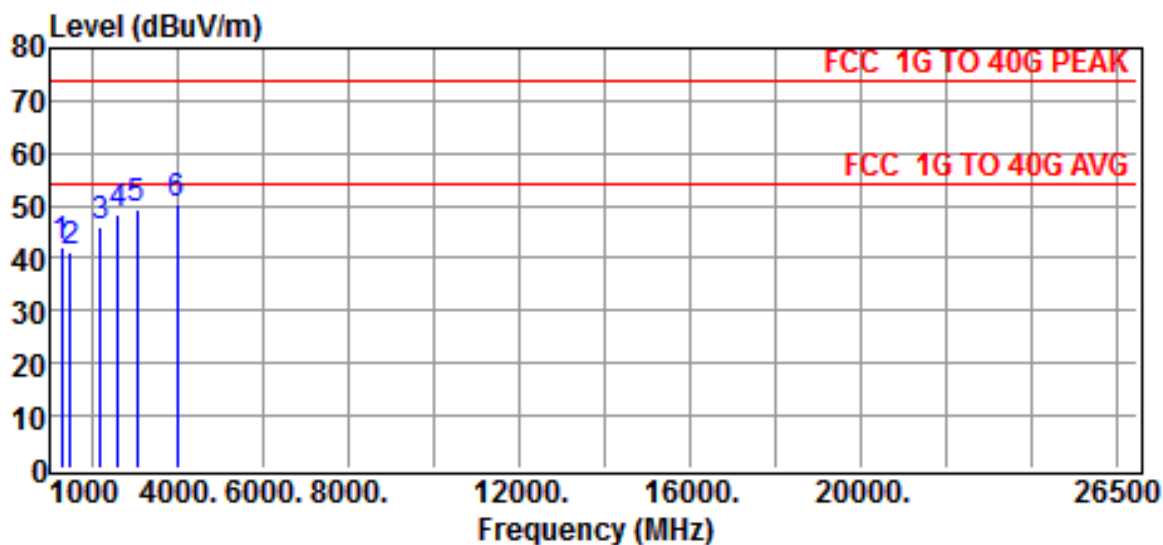
Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC CLASS-B	Ant. Pol.	:VERTICAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:Mode 1-Operation		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	69.4100	35.06	-14.36	20.70	40.00	-19.30	QP
	153.0800	34.16	-7.55	26.61	43.50	-16.89	QP
	247.1500	34.05	-5.41	28.64	46.00	-17.36	QP
	292.9200	35.12	-3.32	31.80	46.00	-14.20	QP
	364.0200	34.93	-1.73	33.20	46.00	-12.80	QP
*	656.3200	35.46	3.70	39.16	46.00	-6.84	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.

b) Emission frequencies above 1 GHz

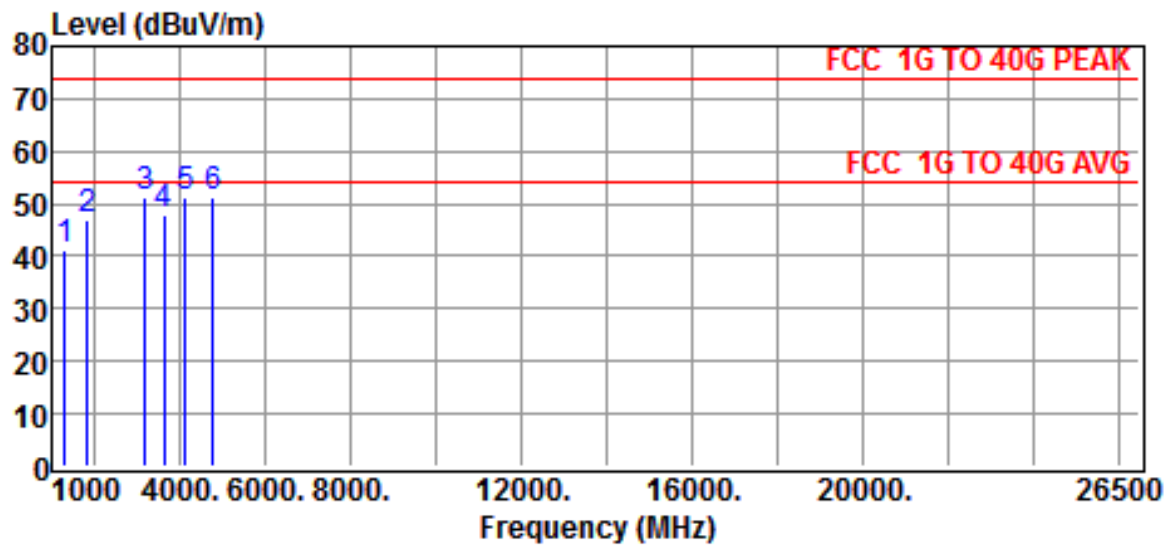


Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:HORIZONTAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:Mode 1-Operation		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	1289.0000	48.83	-6.63	42.20	74.00	-31.80	Peak
	1480.0000	47.75	-6.49	41.26	74.00	-32.74	Peak
	2198.0000	47.51	-1.39	46.12	74.00	-27.88	Peak
	2592.0000	48.33	0.21	48.54	74.00	-25.46	Peak
	3048.0000	47.62	1.52	49.14	74.00	-24.86	Peak
*	3986.0000	47.16	3.11	50.27	74.00	-23.73	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.



Site	:Chamber #2	Date	:2021-06-25
Limit	:FCC 1G TO 40G PEAK	Ant. Pol.	:VERTICAL
EUT	:Miko Drip	Model	: MK-D1010
Power Rating	:3Vdc Battery	Temp.	:22 °C
Engineer	:Kazuma Ho	Humi.	:64 %
Test Mode	:Mode 1-Operation		

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	1300.0000	47.66	-6.61	41.05	74.00	-32.95	Peak
	1829.0000	49.94	-2.96	46.98	74.00	-27.02	Peak
*	3180.0000	47.61	3.73	51.34	74.00	-22.66	Peak
	3637.0000	44.79	2.89	47.68	74.00	-26.32	Peak
	4147.0000	47.65	3.37	51.02	74.00	-22.98	Peak
	4779.0000	46.55	4.72	51.27	74.00	-22.73	Peak

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ()
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. " * " mean this data is the worst emission level.

c) Emission frequencies below 30MHz (9kHz - 30MHz)

According to exploratory test no any obvious emission were detected from 9kHz to 30MHz. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss (if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\textbf{Result = Reading + Corrected Factor}$$

where Corrected Factor

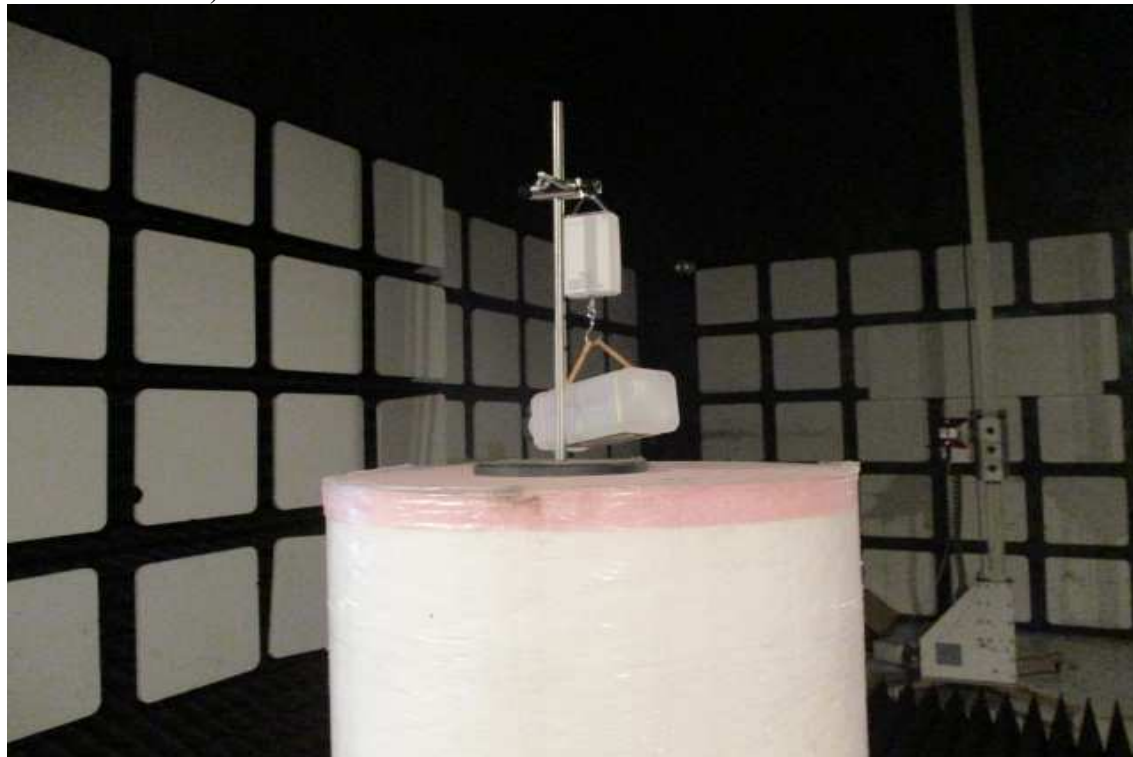
$$= \text{Antenna FACTOR} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$

4.6 Photos of Radiation Measuring Setup

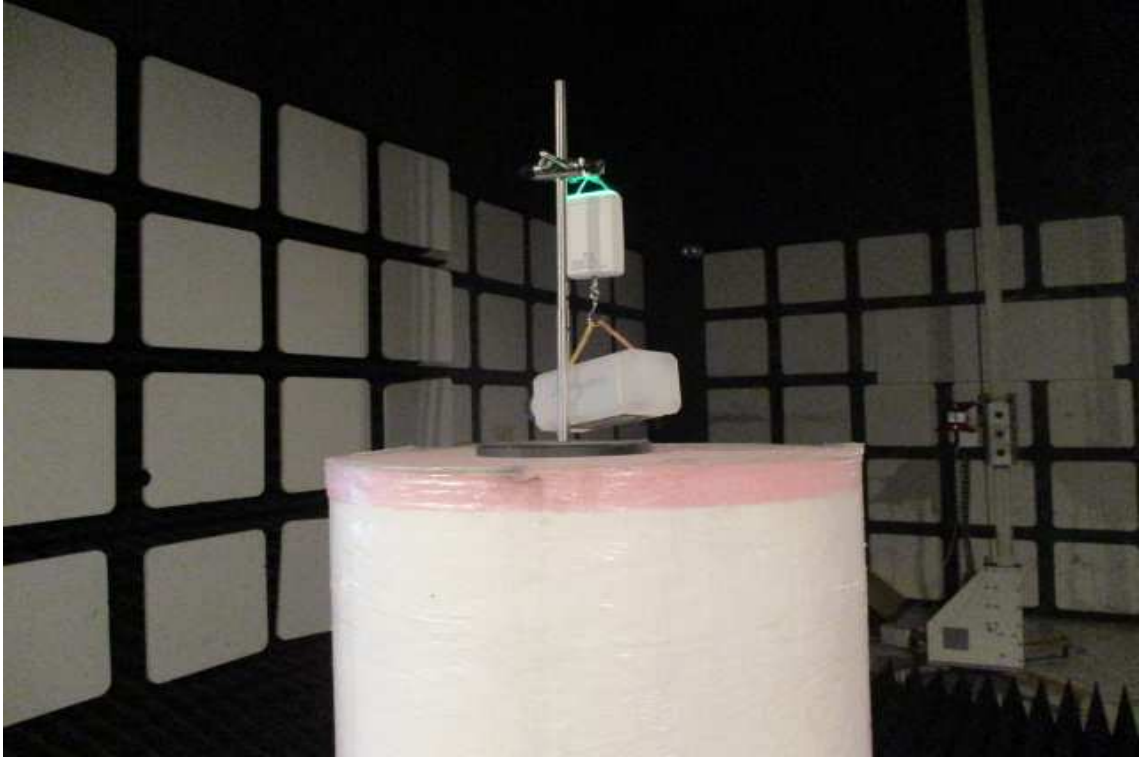
(30MHz to 1GHz)



(Above 1GHz~6GHz)



(6-26.5GHz)



5 CONDUCTED EMISSION MEASUREMENT

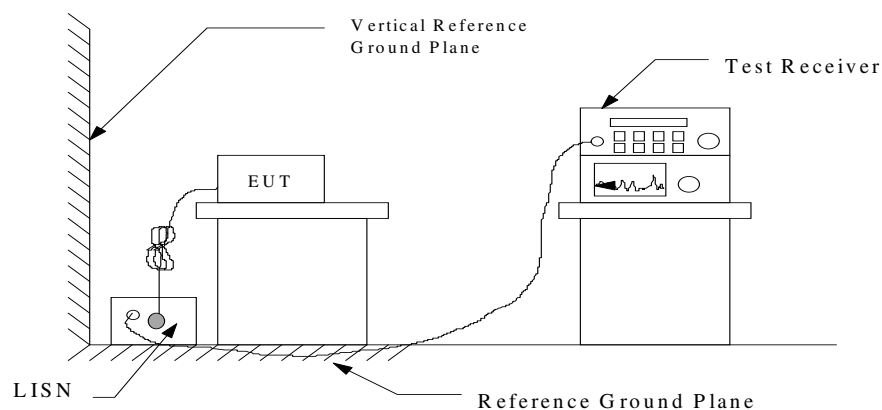
5.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to §15.107(a) and §15.207(a) respectively. Both Limits are identical specification.

5.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



5.3 Conducted Emission Data

This product power source is direct current . this test is not performed.

5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\text{RESULT} = \text{READING} + \text{LISN FACTOR}$$

Assume a receiver reading of 22.5 dBμV is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dBμV.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB}\mu\text{V}$$

$$\begin{aligned} \text{Level in } \mu\text{V} &= \text{Common Antilogarithm}[(22.6 \text{ dB}\mu\text{V})/20] \\ &= 13.48 \mu\text{V} \end{aligned}$$

5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
--	--	--	--	--

5.6 Photos of Conduction Measuring Setup

This product power source is direct current . this test is not performed.

6 ANTENNA REQUIREMENT

6.1 Standard Applicable

For intentional device, according to 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.

6.2 Antenna Construction

The antenna is permanently mounted on main PCB, no consideration of replacement. Please see internal photos and the antenna specifications.

7 EMISSION BANDWIDTH MEASUREMENT

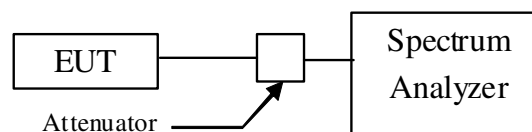
7.1 Standard Applicable

According to 15.247(a)(2), for direct sequence system, the minimum 6dB bandwidth shall be at least 500 kHz.

7.2 Measurement 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 figure 4 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. Set a reference level on the measuring instrument equal to the highest peak value. The settings of spectrum analyzer is as followings.
 - 1) Set RBW = 100 kHz.
 - 2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
 - 3) Detector = Peak.
 - 4) Trace mode = max hold.
 - 5) Sweep = auto couple.
 - 6) Allow the trace to stabilize.
 - 7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
3. Repeat above procedures until all frequencies measured were complete.

Figure 4: Measurement configuration.



7.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

7.4 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

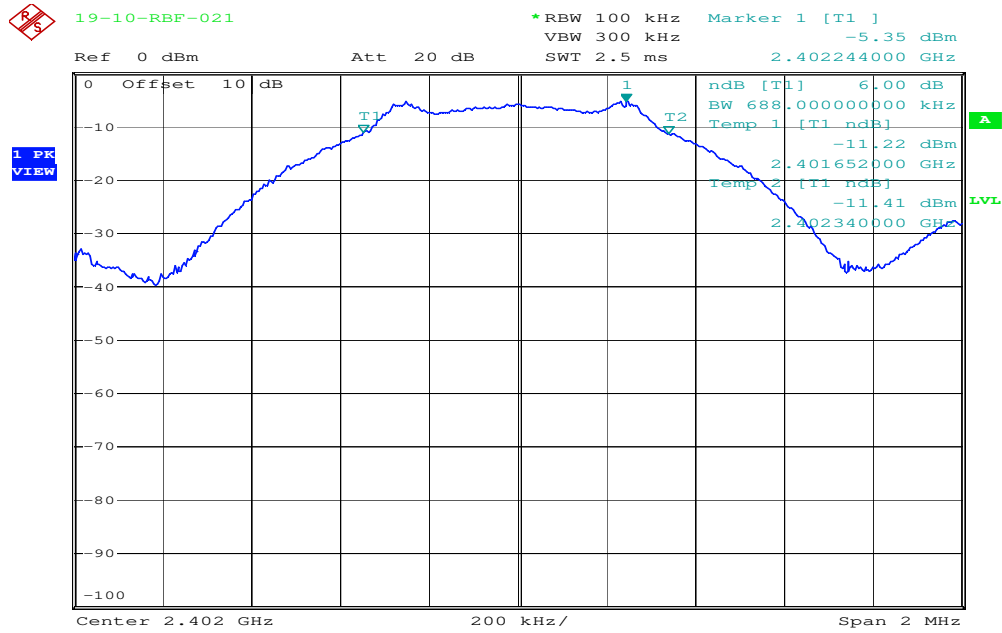
Mode: Bluetooth BLE

a) Channel Low : 6 dB Emission Bandwidth is 0.688 MHz

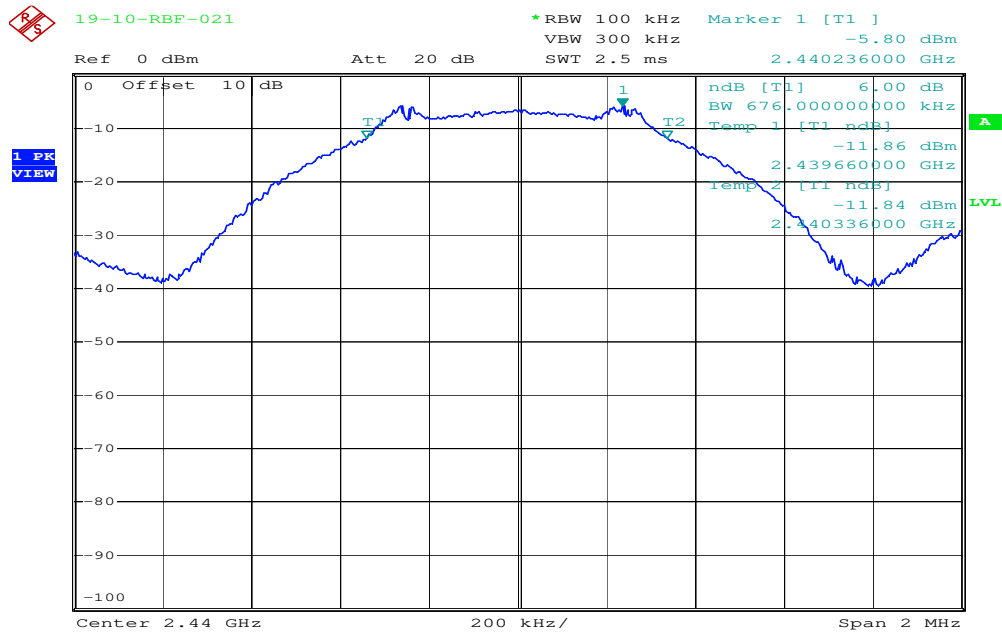
b) Channel Middle : 6 dB Emission Bandwidth is 0.676 MHz

c) Channel High : 6 dB Emission Bandwidth is 0.676 MHz

Note : The expanded uncertainty: frequency $\times 1.65 \times 10^{-6}$ ($1 \text{ GHz} < f \leq 18 \text{ GHz}$).

Mode: Bluetooth BLR**Channel Low**

Date: 5.FEB.2020 10:56:31

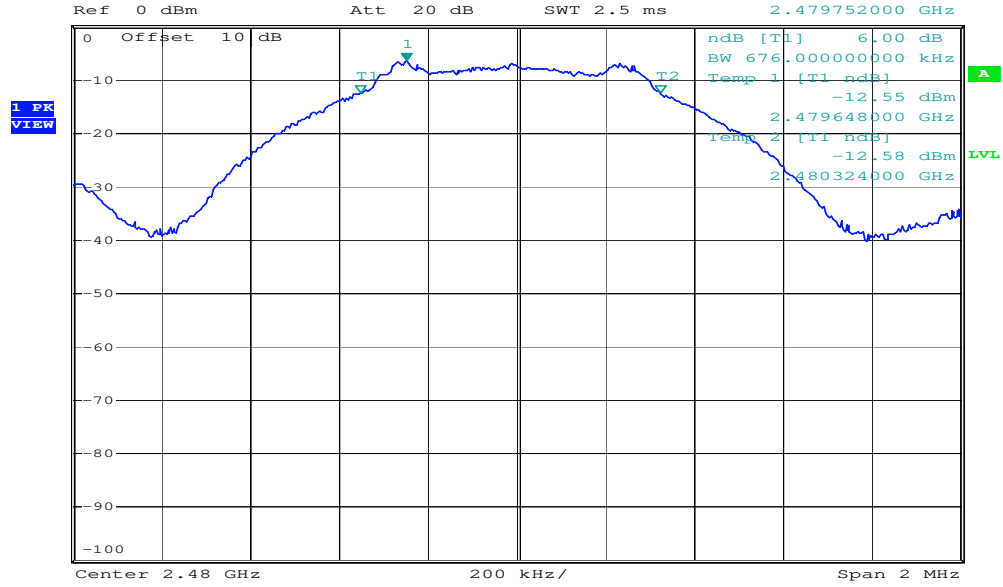
Channel Middle

Date: 5.FEB.2020 10:58:23

Channel High

19-10-RBF-021

*RBW 100 kHz Marker 1 [T1]
VBW 300 kHz -6.51 dBm
SWT 2.5 ms 2.479752000 GHz



Date: 5.FEB.2020 10:59:04

8 OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

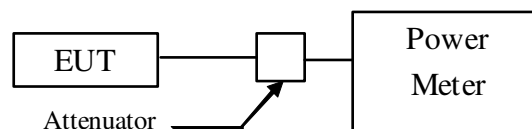
8.2 Measurement Procedure

Measurement Procedure:

9.1.2 PKPM1 Peak power meter method

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 figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable.
3. Record the readings on the instrument and add a compensat factor of the attenuator.
4. Repeat above procedures until all frequencies measured were complete.

Figure 5: Output power and measurement configuration.



8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

8.4 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

Measurement Procedure:

9.1.2 PKPM1 Peak power meter method

Output Peak Power		dBm	mW
Bluetooth BLE	Channel Low:2402MHz	-5.05	0.313
	Channel Mid:2440MHz	-5.63	0.274
	Channel High:2480MHz	-6.42	0.228

Note : The expanded uncertainty: 2dB.

9 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1 Standard Applicable

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

9.2 Measurement 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 figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW of spectrum analyzer to 100kHz and VBW to 1 MHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

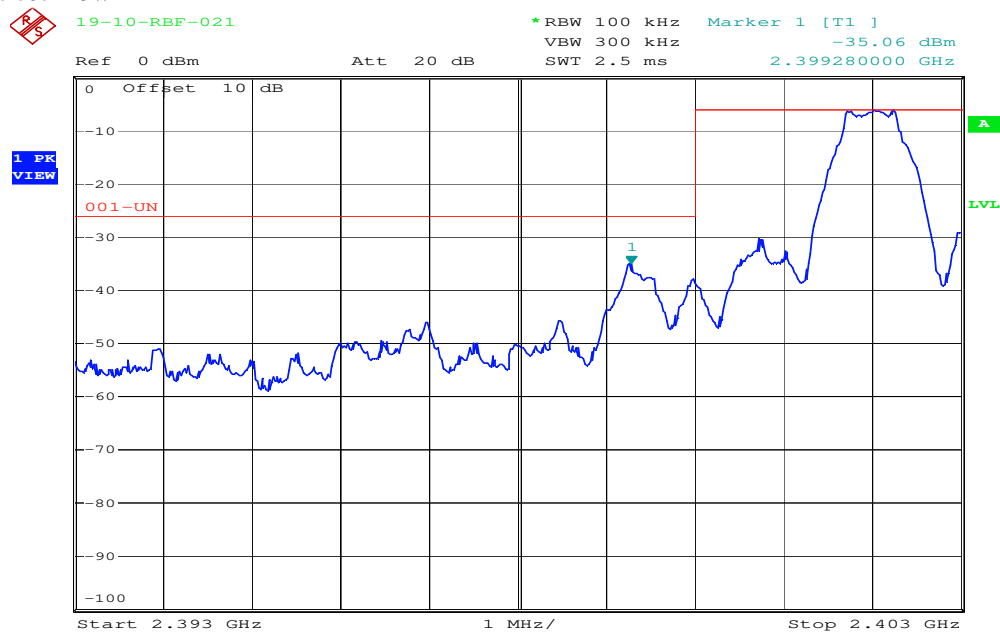
9.4 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

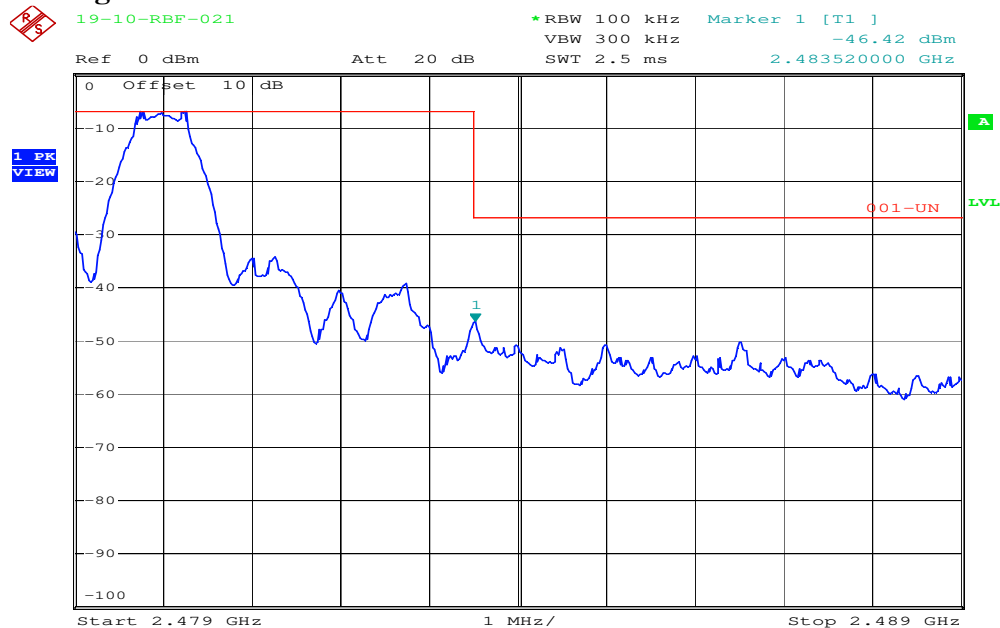
Mode: Bluetooth BLE

- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

Note : The expanded uncertainty: 2dB.

Mode:Bluetooth BLE**Channel Low**

Date: 5.FEB.2020 11:11:02

Channel High

Date: 5.FEB.2020 11:09:54

10 POWER DENSITY MEASUREMENT

10.1 Standard Applicable

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

10.2 Measurement Procedure

Measurement Method: PKPSD

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 figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set analyzer center frequency to DTS channel center frequency.
4. Set the span to 1.5 times the DTS bandwidth.
5. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
6. Set the VBW $\geq 3 \times \text{RBW}$.
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum amplitude level within the RBW.
12. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
13. Repeat above procedures until all measured frequencies were complete.

10.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

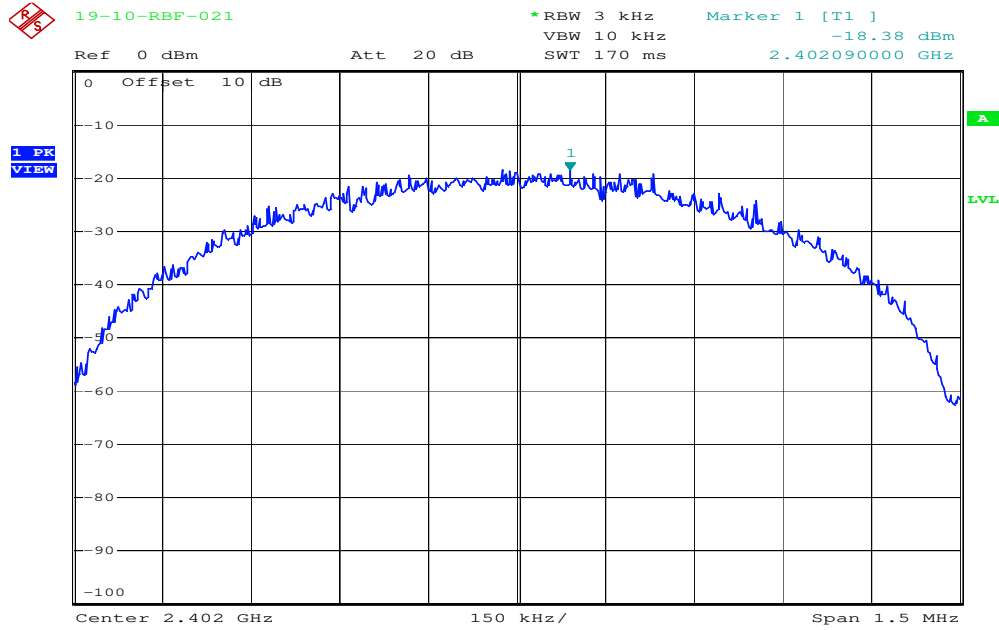
10.4 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

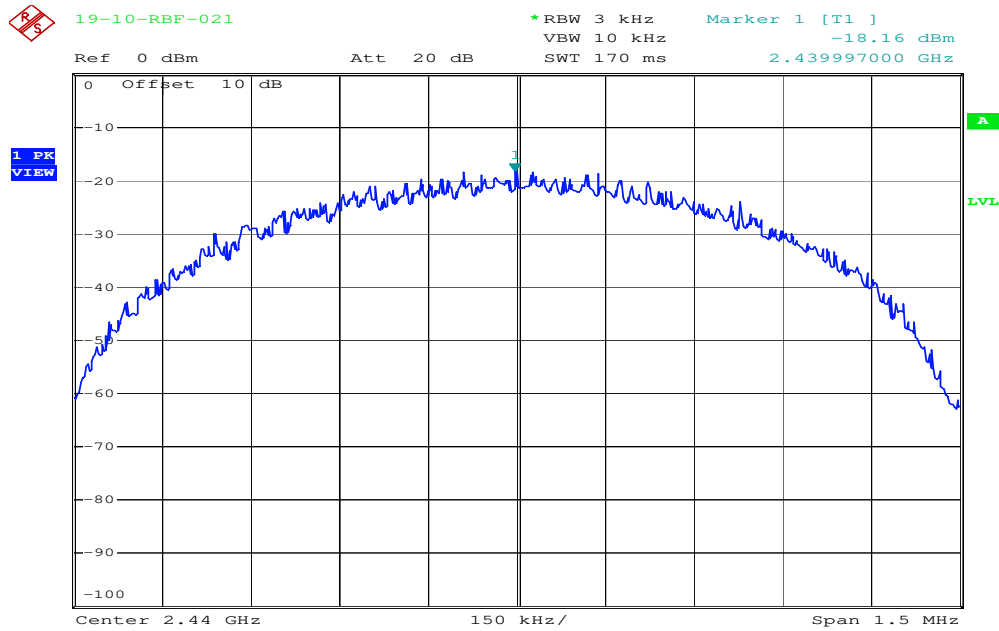
Mode: Bluetooth BLE

- a) Channel Low: Maximun PSD is -18.38 dBm
- b) Channel Mid: Maximun PSD is -18.16 dBm
- c) Channel High: Maximun PSD is -19.27 dBm

Note : The expanded uncertainty: 2dB.

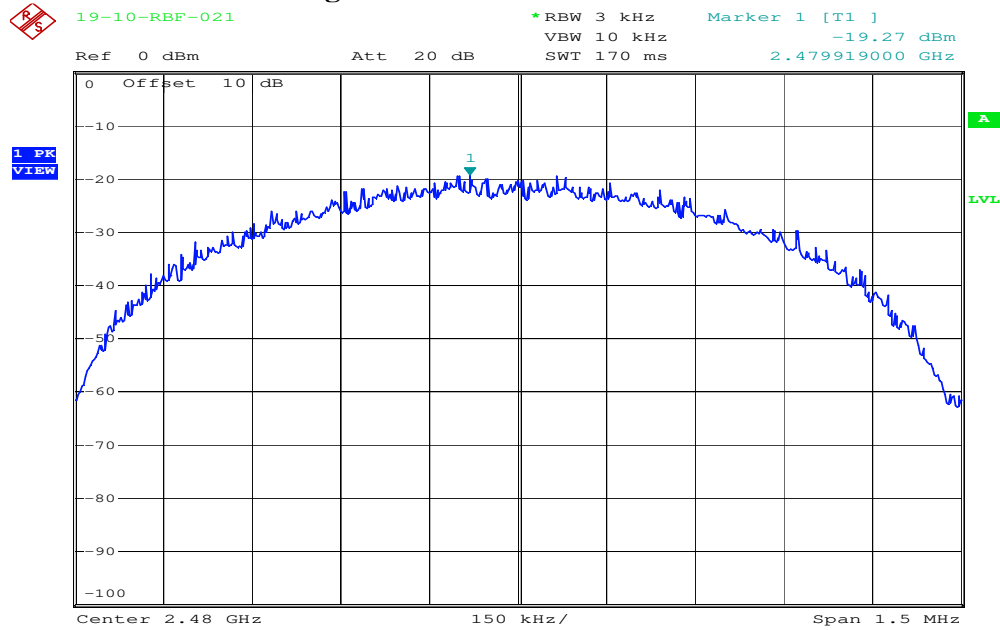
Bluetooth BLE / Channel Low

Date: 5.FEB.2020 11:06:31

Bluetooth BLE / Channel Mid

Date: 5.FEB.2020 11:07:17

Bluetooth BLE / Channel High



Date: 5.FEB.2020 11:07:59

11. OUT-OF-BAND CONDUCTED EMISSION MEASUREMENT

11.1 Standard Applicable

According to 15.247(c), 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. Attenuation below the general limits specified in Section 15.209(a) is not required.

11.2 Measurement 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 figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

3. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold.

4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

11.4 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

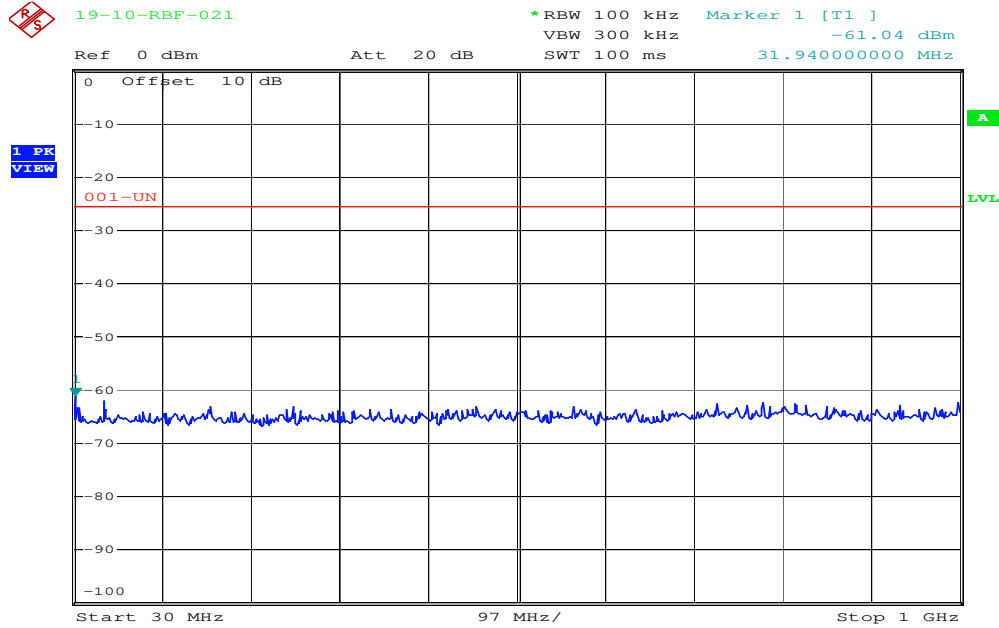
A. Bluetooth BLE

Mode: Channel Low, Mid, High

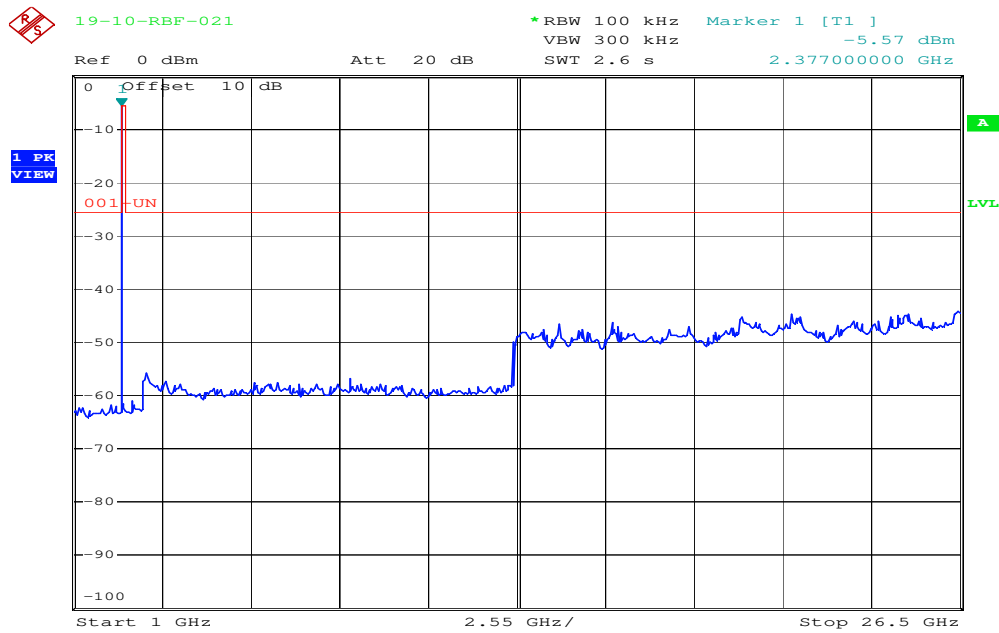
(a) 30 MHz to 1 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

(b) 1 GHz to 26.5 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

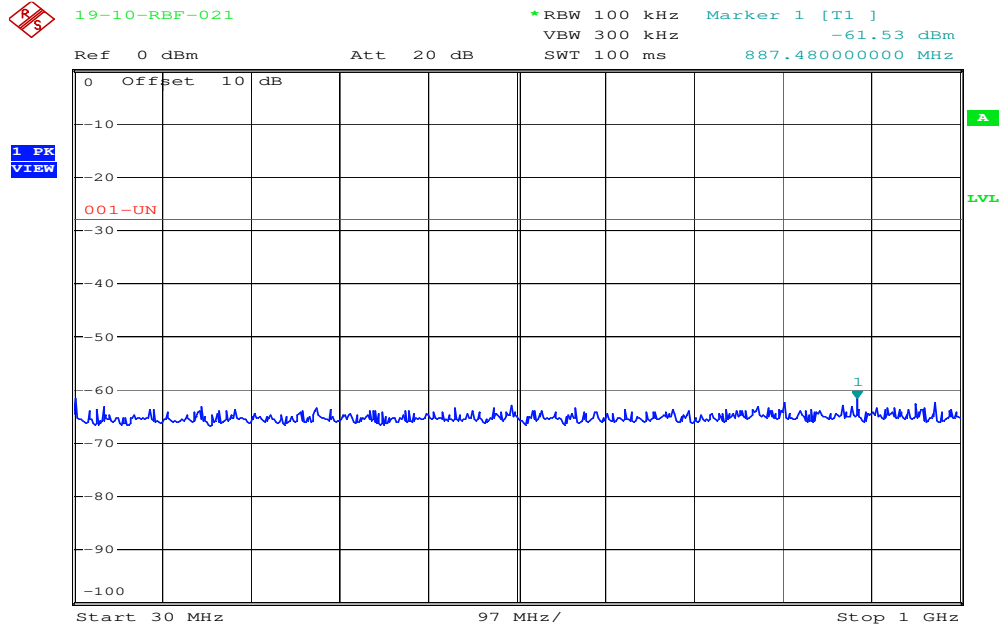
Note : The expanded uncertainty: 2dB.

Bluetooth BLE**Channel Low**

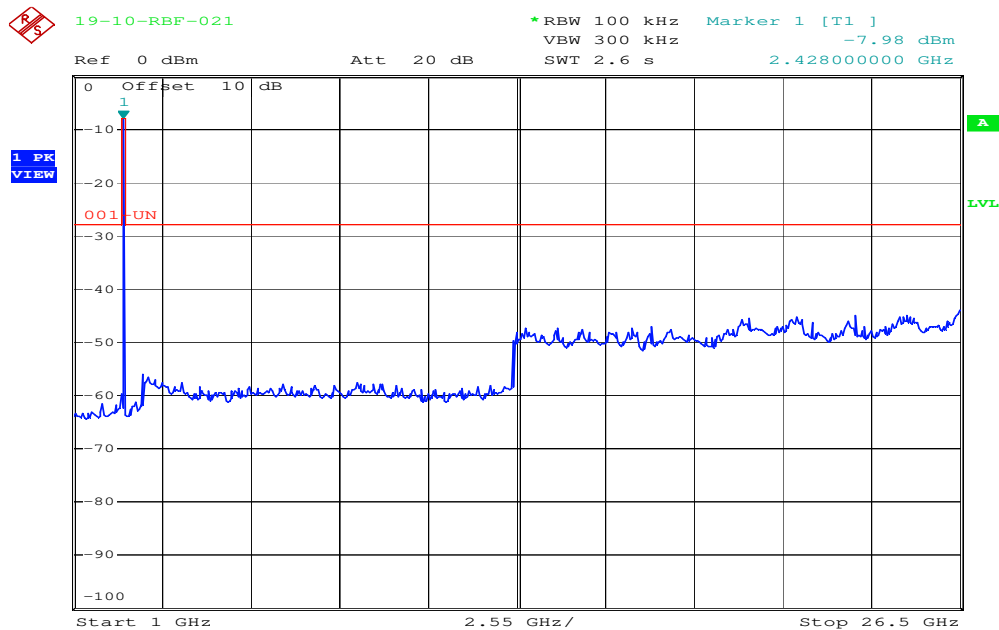
Date: 5.FEB.2020 11:13:25



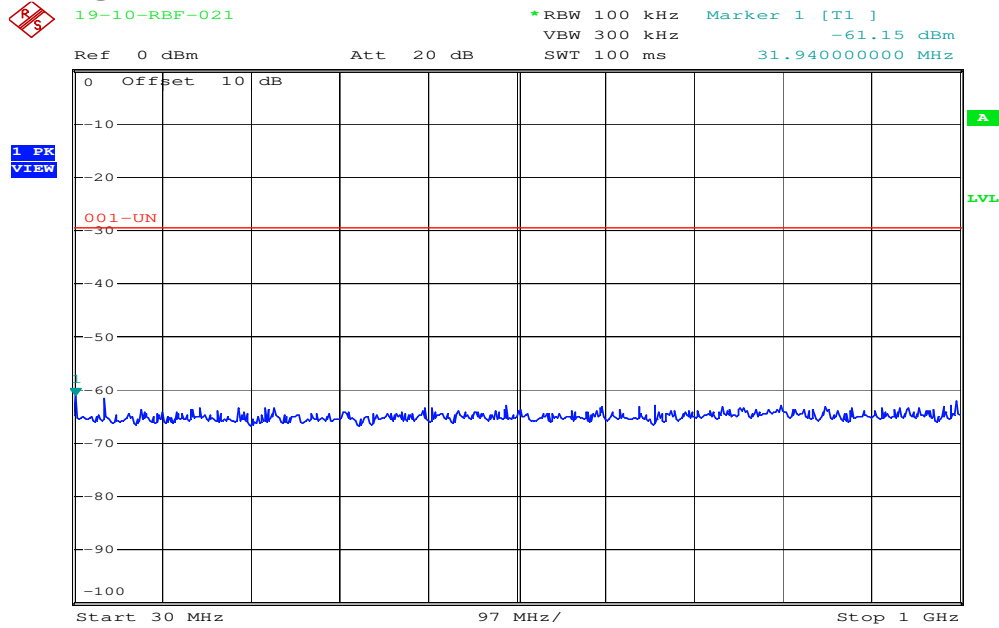
Date: 5.FEB.2020 11:13:02

Bluetooth BLE**Channel Mid**

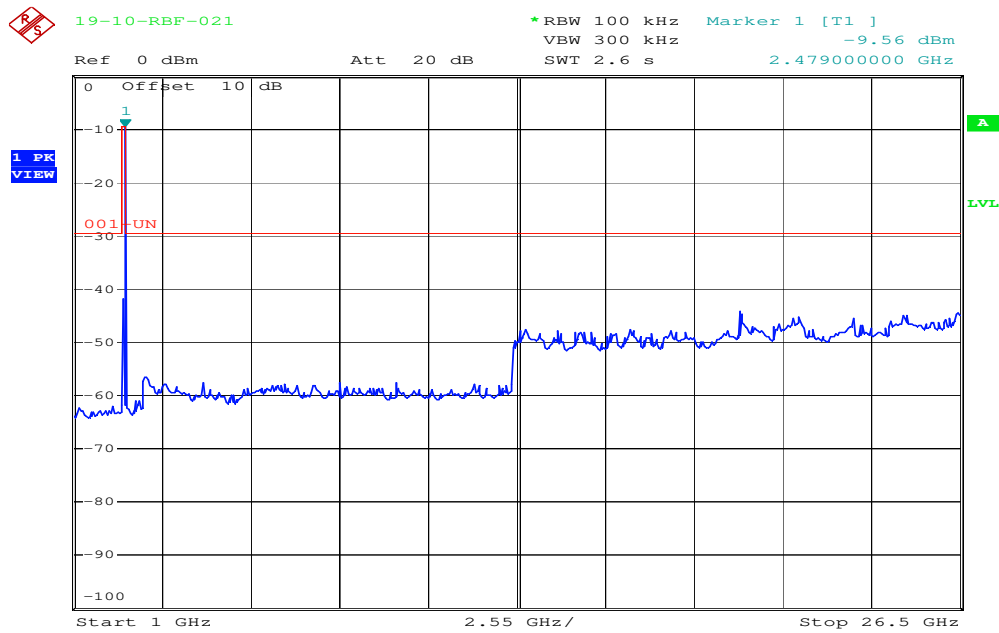
Date: 5.FEB.2020 11:15:19



Date: 5.FEB.2020 11:14:52

Bluetooth BLE**Channel High**

Date: 5.FEB.2020 11:16:48



Date: 5.FEB.2020 11:16:26

12. DUTY CYCLE

12.1 Standard Applicable

None. Referency only.

12.2 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2020/01/15	2021/01/14

12.3 Measurement Data

Test Data: 2020/2/5 Temp: 20 °C Hum: 70 %

Duty Cycle Calculation

Mode	Period (ms)	Transmission duration (T) (ms)	Duty Cycle (%)	1/T (kHz)	VBW setting (kHz)
BLE	100.00	100.00	100.00	0.010	0.01

Note:

1. When the duty cycle is less than 98%, for the average measurement of the radiated emission test, the VBW setting is $>1/T$ where the T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Refer to the following page for data plots.

Bluetooth BLE



19-10-RBF-021

RBW 1 MHz

Delta 1 [T1]

VBW 3 MHz

-0.04 dB

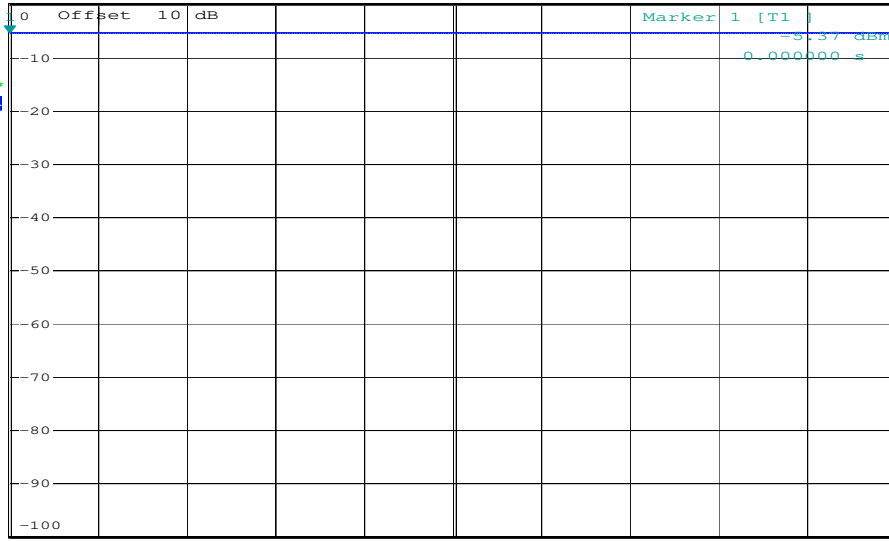
SWT 100 ms

100.000000 ms

Ref 0 dBm

Att 20 dB

1 PR
CLRWR



SGL

LVL

Center 2.402 GHz

10 ms/

Date: 5.FEB.2020 10:54:30