Global No.1 Testing Laboratory Universal Certification Solution

FCC TEST REPORT

Product name:	BLE Module
FCC ID:	2AMD4UTO-NBL-52A
Model:	UTO-NBL-52A
Standards:	FCC CFR 47 PART 15 SUBPART C, Section 15.247
Applicant:	Utovertek Co.,Ltd.
Test Report No.:	UCSFR-1706-002

UCS Co., Ltd.

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FCC Test Report

Report Number		UCSFR-1706-002		
Applicant	Company Name	Utovertek Co.,Ltd.		
	Address	Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si,Gyeonggi-do 463-816 Korea		
Product	Product Name	BLE Module		
	FCC ID	2AMD4UTO-NBL-52A		
	Model No.	UTO-NBL-52A		
	Family Model Name	UTO-NBL-52		
	Manufacturer	Utovertek Co.,Ltd.		
	Serial No.	-	Country of origin	Korea
Other	Receipt Date	2017.05.17	Receipt Number	UCS-R-2017-0588
	Issued Date	2017.06.05	Tested Date	2017.05.29 ~ 2017.05.30
Standards		FCC CFR 47 PART 15 SUBPART C, Section 15.247		
Tested by		Y. S. Choi (Sign)		
Approved by		H. K. Lee (Sign)		

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o This is certified that the above mentioned products have been tested for the sample provided by client.

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
UCSFR-1706-002	05-June-17	Initial Issue	All

1. Applicant Information

Applicant Name	: Utovertek Co.,Ltd.
Address	: Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si, Gyeonggi-do 463-816 Korea
Applicant Name	: Utovertek Co.,Ltd.
Address	: Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si, Gyeonggi-do 463-816 Korea
Country of Origin	: KOREA

2. EUT (Equipment under test) Information

Product name	BLE Module
Basic Model name	UTO-NBL-52A
Family Model Name	UTO-NBL-52
Power source	DC 3.0 V
Output Power	MAX 0.000 574 W
Ferquency range	2 402 MHz ~ 2 480 MHz
Number of channels	40 Ch
Modulation Technique	GFSK (Bluetooth 4.2)
Antenna specification	Chip Antenna / 1.9 dBi (Peak Gain)
Printer size	4.00 x 2.00 x 1.25 mm

3. Laboratory Information

UCS Co., Ltd.

#702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea.

ER Center

- #35-13 Hwalcho-gil, 109beon-gil, Hwaseong-si, Gyeonggi-do, 18278 Korea

Test site

- FCC Registration Number: 767461
- This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

4. Test Configuration and Condition

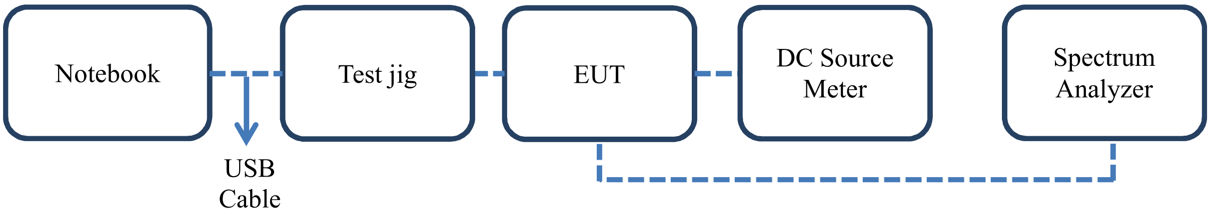
4.1 EUT operating condition

- The EUT had been tested under the operating condition.
- There are three channels have been tested as following:
- Channel Low and Channel High with higher data rate were chosen for full testing.

Channel	Frequency (MHz)
Low	2 402
Middle	2 440
High	2 480

- The measurements were taken in continuous transmitting mode using the TEST MODE.
- For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.

4.2 EUT test configuration diagram



4.3 Peripheral equipments list for test

Equipment Name	Model	Serial Number	Manufacturer
Notebook computer	NT910S3P	0GG291FG700325F	Samsung Electronics Suzhou Computer Co., Ltd.
DC Source Meter	M8811	80010960011103000	Maynuo
Test jig	-	-	NORDIC SEMICONDUCTOR

4.4 Cable connections

Start		End		Cable	
Name	I/O Port	Name	I/O Port	Length	Spec.
EUT	DC in	DC Source Meter	DC out	1.5	Unshielded
	Signal in	Test jig	Signal out	0.2	Unshielded
Test jig	Micro USB	Notebook	USB	1.0	Shielded

4.5 EUT modifications

- None

5. Summary of Test Results and Measurement Procedures

5.1 Summary of test results

Standard	Test Item	CFR 47 Section	Result
FCC CFR 47 PART 15 SUBPART C, Section 15.247	Antenna Requirement	15.203, 15.247(b)(4)	PASS
	6 dB Bandwidth	15.247(a)(2)	PASS
	Maximum Peak Output Power	15.247(b)(1)	PASS
	Peak Power Spectral Density	15.247(a)(1)	PASS
	Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.209	PASS
	AC Power Line Conducted Emissions	15.207	PASS
	RF Exposure	15.247(i), .1307(b)(1)	PASS

- The tests were performed according to the method of measurements prescribed in KDB No.558074 D01 DTS Meas Guidance v03r05

5.2 AC Powerline conducted emission test

The EUT was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

5.3 Radiated emission test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10:2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m open area test site.
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. Test Results

6.1 Antenna requirement

6.1.1 Regulation

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.
The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.
The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.
Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.1.2 Results: Pass

The transmitter has an integral Chip antenna. The directional gain of the antenna is 1.9 dBi.

6.2 6 dB bandwidth

6.2.1 Regulation

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 MHz ~ 928 MHz, 2 400 MHz ~ 2 483.5 MHz, and 5 725 MHz ~ 5 850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2.2 Test condition

- Set RBW of Spectrum analyzer to 100 kHz, Span = 2 MHz, Sweep = auto
- The 6 dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 6 dB

6.2.3 Results: Pass

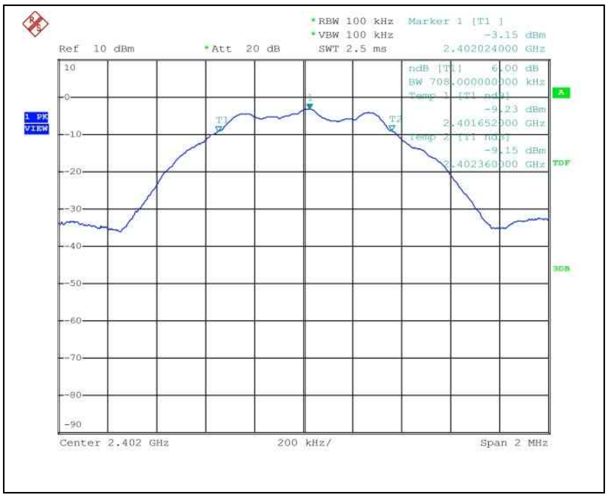
Table 1 : Measured values of the 6 dB bandwidth

Mode	Frequency [MHz]	Result [kHz]	Limit [kHz]	Result
GFSK (Bluetooth 4.2)	2 402	708	> 500	PASS
	2 440	704		PASS
	2 480	700		PASS

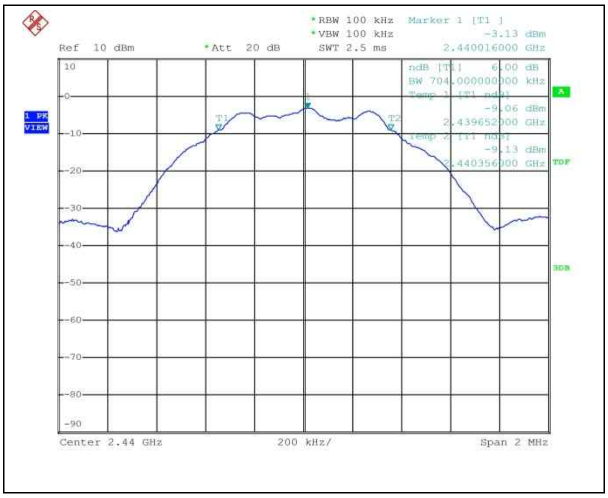
6.2.4 Graph of the 6 dB channel bandwidth

GFSK (Bluetooth 4.2)

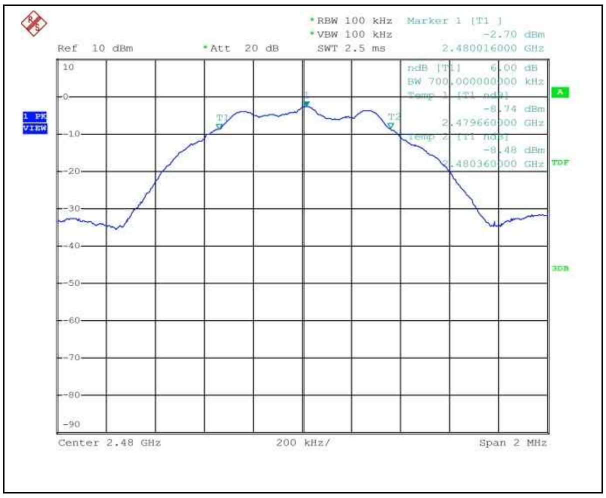
Lowest Channel



Middle Channel



Highest Channel



6.3 Maximum peak output power

6.3.1 Regulation

According to §15.247(b)(3), For systems using digital modulation in the 902 ~ 928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2 Test condition

- Set RBW of Spectrum analyzer to 1 MHz
- The Maximum Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. For frequency hopping systems operating in the 2 400 MHz ~ 2 483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5 725 MHz ~ 5 850 MHz band: 1 watt.

6.3.3 Results: Pass

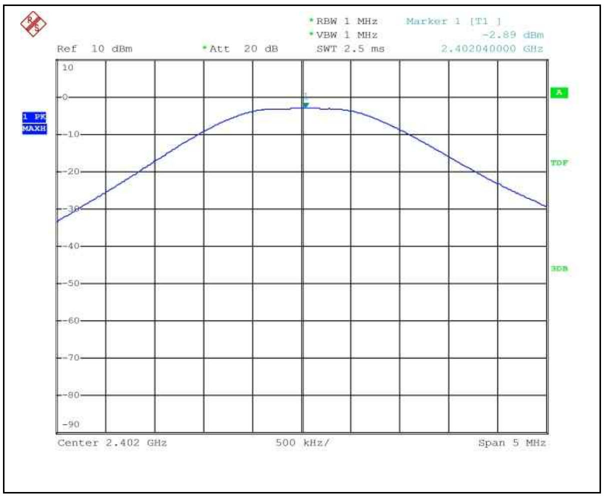
Table 2 : Measured values of the maximum peak output power (Conducted)

Mode	Frequency [MHz]	Reading Power [dBm]	Output Power [W]	Limit [W]	Result
GFSK (Bluetooth 4.2)	2 402	-2.89	0.000 514	1	PASS
	2 440	-2.87	0.000 516		PASS
	2 480	-2.41	0.000 574		PASS

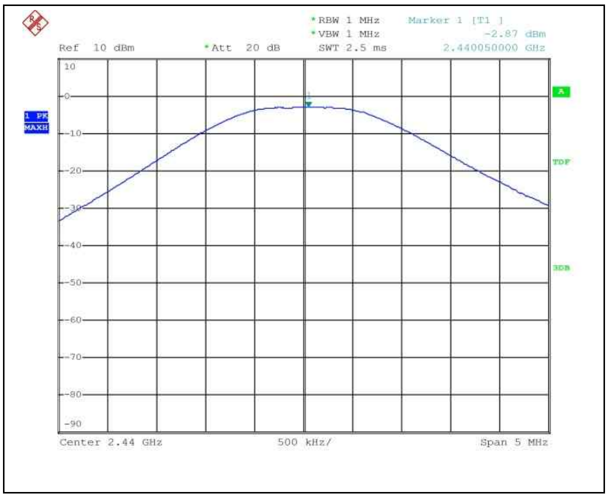
6.3.4 Graph of the Maximum Peak Output Power (Conducted)

GFSK (Bluetooth 4.2)

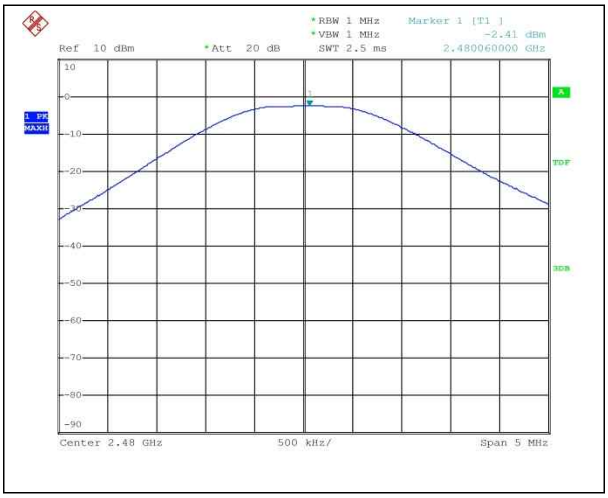
Lowest Channel



Middle Channel



Highest Channel



6.4 Peak power spectral density

6.4.1 Regulation

According to §15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.4.2 Test condition

- Set RBW of Spectrum analyzer to 3 kHz, Span = 1 MHz, Sweep = Auto
- The transmitter output was connected to a spectrum analyzer and the maximum level in a 3 kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time ≥ span / 3 kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3 kHz resolution bandwidth.

6.4.3 Results: Pass

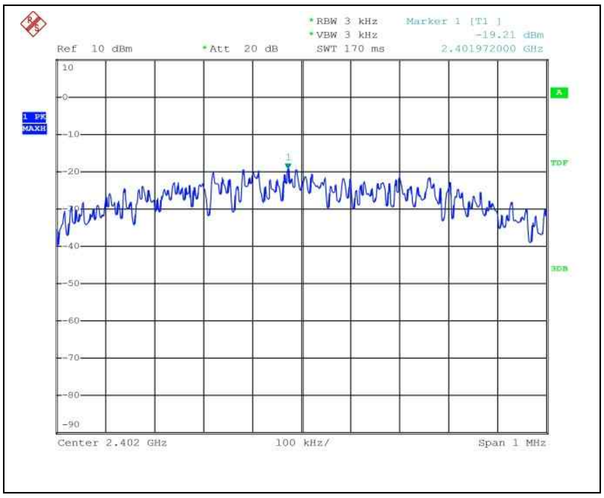
Table 3 : Measured values of the peak power spectral density

Mode	Frequency [MHz]	Peak frequency [MHz]	Peak power spectral density [dBm/3 kHz]	Limit [dBm/3 kHz]	Result
GFSK (Bluetooth 4.2)	2 402	2 401.972	-19.21	< 8	PASS
	2 440	2 439.972	-19.17		PASS
	2 480	2 479.972	-18.87		PASS

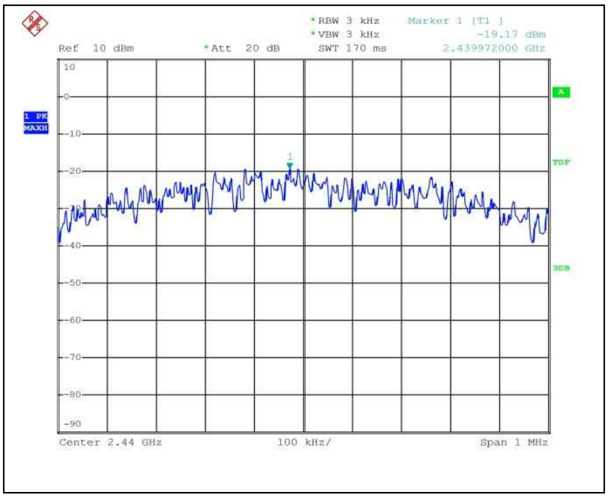
6.4.4 Graph of the peak power spectral density

GFSK (Bluetooth 4.2)

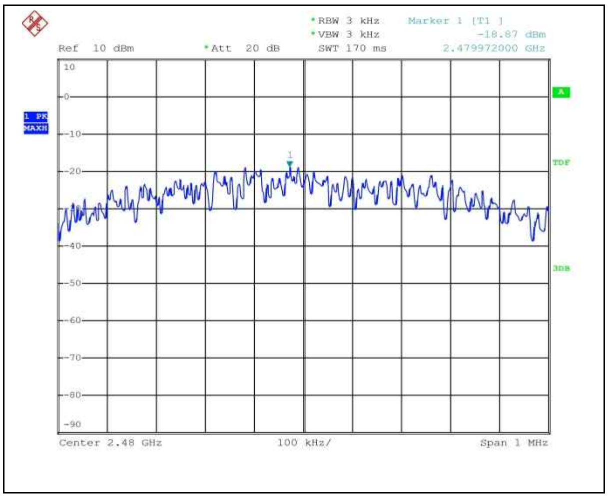
Lowest Channel



Middle Channel



Highest Channel



6.5 Spurious emissions and band edge, restricted bands

6.5.1 Regulation

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 emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

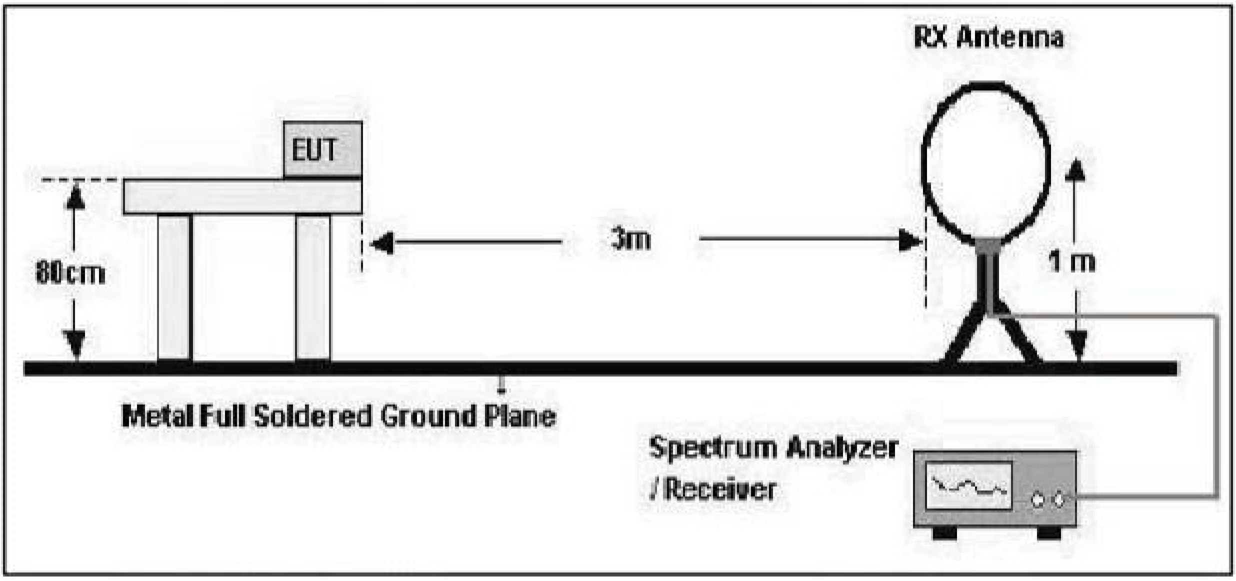
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	**Field strength [µV/m]**	**Field strength [dBµV/m]**	**Measurement distance [m]**
0.009 ~ 0.490	2 400 / F (kHz)	-	300
0.490 ~ 1.705	24 000 / F (kHz)	-	30
1.705 ~ 30	30	29.54	30
30 ~ 88	100	40.00	3
88 ~ 216	150	43.52	3
216 ~ 960	200	46.02	3
Above 960	500	53.98	3

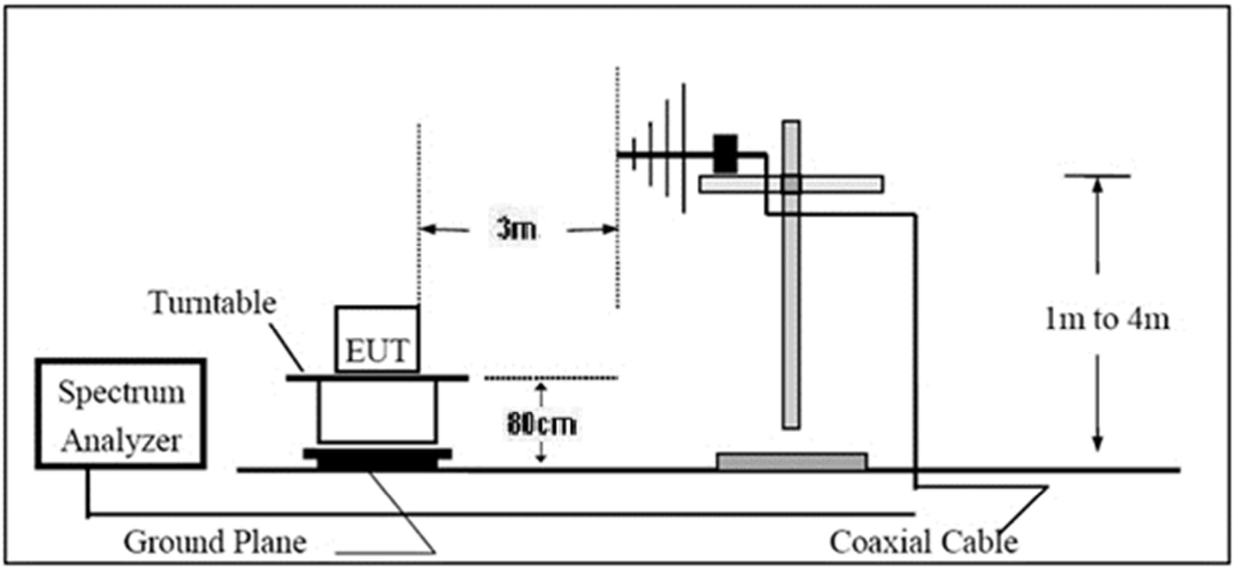
The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1 000 MHz are based on the average value of measured emissions.

6.5.2 Test setup layout

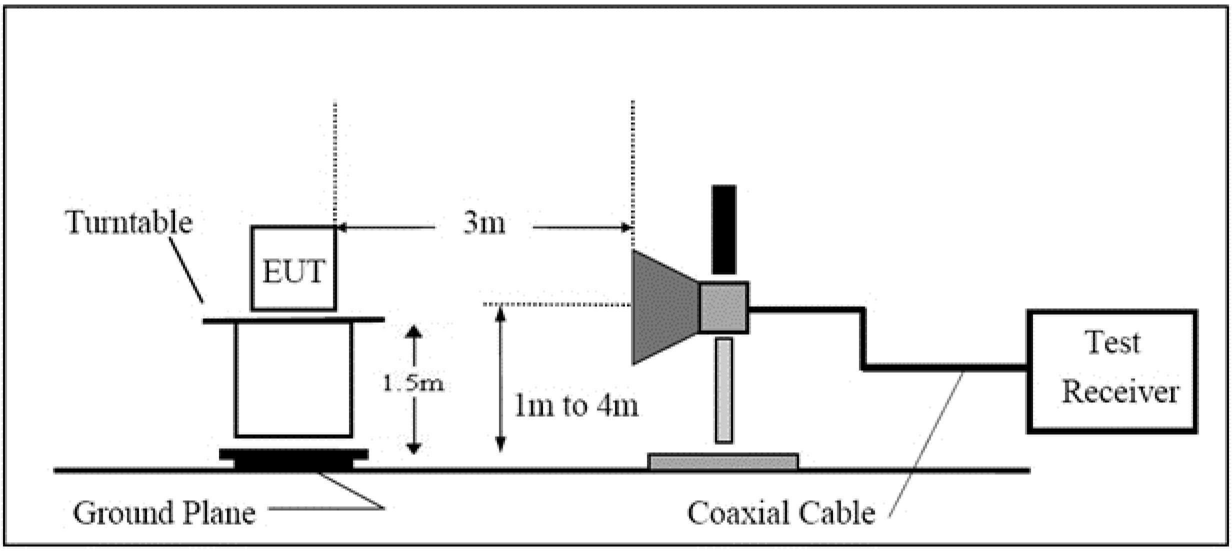
6.5.2.1 Radiated emission test set-up, frequency below 30 MHz



6.5.2.2 Radiated emission test set-up, frequency below 1 000 MHz



6.5.2.3 Radiated emission test set-up frequency above 1 000 MHz



6.5.3 Test procedure

1) Band-edge compliance of RF conducted emissions

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1 % of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF conducted emissions:

1. Set the spectrum analyzer as follows:

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 10^{th} harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious radiated emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.

2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 MHz to 1 000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.

4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-delta method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1 % of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above spurious radiated emissions test procedure.

6.5.4 Results: Pass

Band-edge compliance of RF conducted/radiated emissions was shown in the 6.5.5 and 6.5.6

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Spurious RF conducted emissions were shown in the 6.5.7

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Table 4 : Measured values of the field strength of spurious emission

Frequency [MHz]		Detect Mode	Polarization [V/H]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz						
		It was not found any emissions peaks found from the EUT.				
Quasi-peak data, emissions below 1 000 MHz						
2 402	37.34	Qausi-peak	V	36.76	40.00	-22.16
	111.38	Qausi-peak	H	22.41	43.52	-15.52
	238.61	Qausi-peak	H	34.86	46.02	-25.37
	562.53	Qausi-peak	V	31.04	46.02	-17.04
	576.75	Qausi-peak	V	33.44	46.02	-22.27
	843.56	Qausi-peak	V	36.58	46.02	-24.97
2 440	33.07	Qausi-peak	V	36.68	40.00	-22.90
	112.06	Qausi-peak	H	23.18	43.52	-15.23
	238.79	Qausi-peak	H	35.16	46.02	-23.73
	480.96	Qausi-peak	H	38.27	46.02	-16.63
	563.49	Qausi-peak	V	31.28	46.02	-22.94
	850.28	Qausi-peak	V	41.97	46.02	-15.40
2 480	34.78	Qausi-peak	V	26.44	40.00	-22.16
	111.79	Qausi-peak	V	15.59	43.52	-15.52
	114.83	Qausi-peak	H	16.55	43.52	-25.37
	239.04	Qausi-peak	H	24.37	46.02	-17.04
	576.01	Qausi-peak	H	23.21	46.02	-22.27
	844.68	Qausi-peak	V	27.12	46.02	-24.97

* Remark: "H" Horizontal, "V" Vertical

* **Margin [dB]** = Emission Level [dBμV/m] – Limit [dBμV/m

Table 5 : Measured values of the field strength of spurious emission

Frequency [MHz]		Detect Mode	Polarization [V/H]	Emission Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
Peak/Average data, emissions above 1 000 MHz						
2 402	4 803.00	Peak	H	51.84	74.00	-22.16
	4 803.00	Average	H	38.48	54.00	-15.52
	4 803.00	Peak	V	48.63	74.00	-25.37
	4 803.00	Average	V	36.96	54.00	-17.04
2 440	1 351.00	Peak	V	51.73	74.00	-22.27
	1 351.00	Average	V	29.03	54.00	-24.97
	4 882.00	Peak	H	51.10	74.00	-22.90
	4 882.00	Average	H	38.77	54.00	-15.23
2 480	4 803.00	Peak	H	51.06	74.00	-22.94
	4 803.00	Average	H	38.60	54.00	-15.40
	5 859.00	Peak	V	50.27	74.00	-23.73
	5 859.00	Average	V	37.37	54.00	-16.63

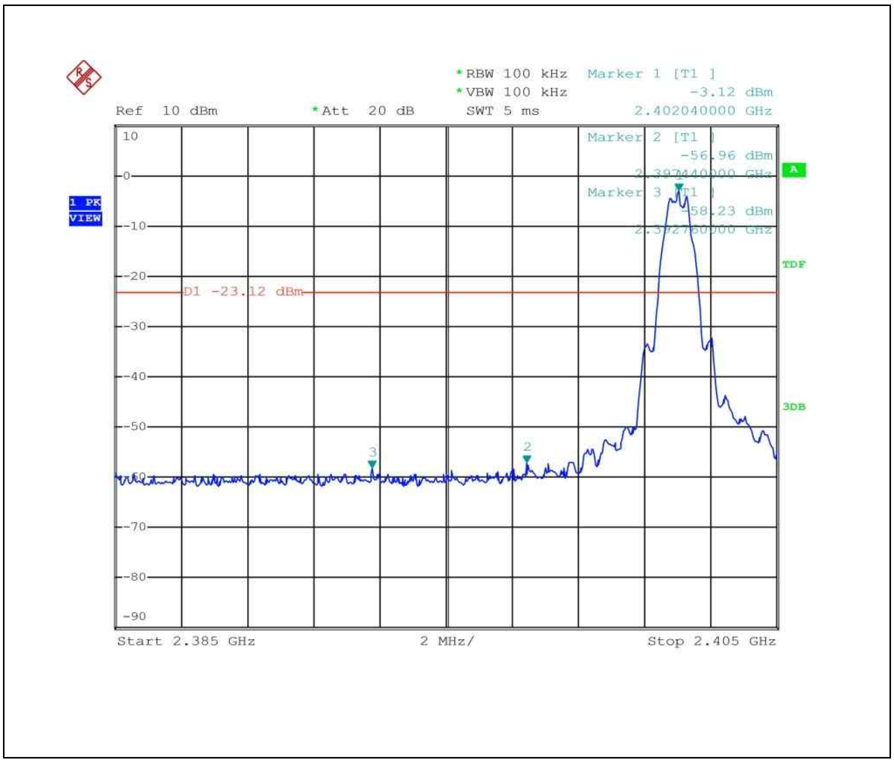
* Remark: “H” Horizontal, “V” Vertical

* **Margin [dB]** = Emission Level [dBµV/m] – Limit [dBµV/m]

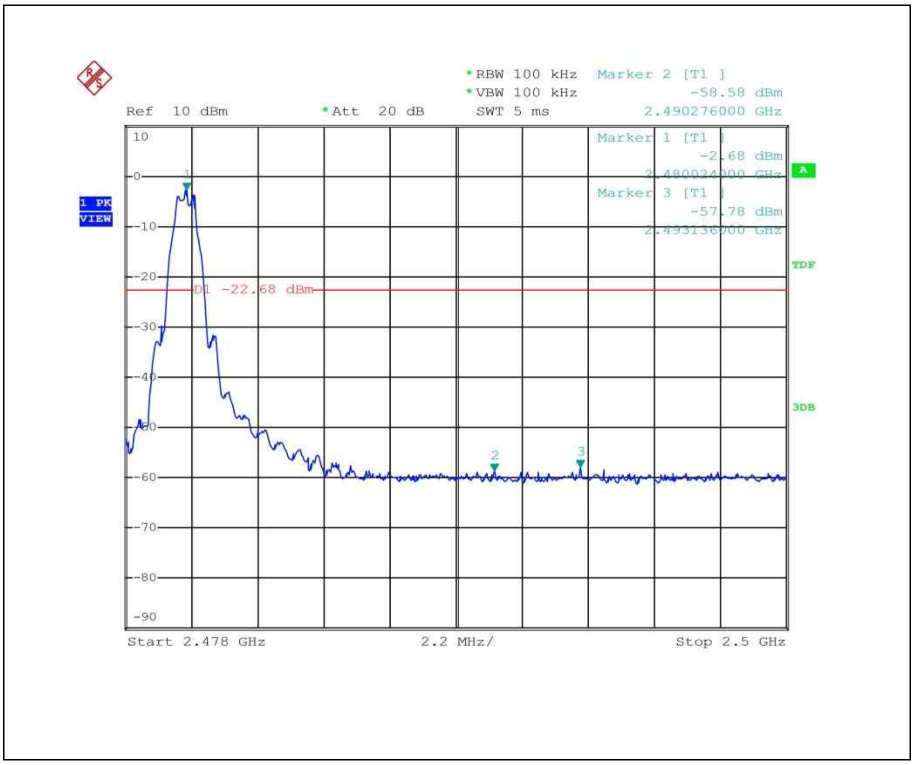
6.5.5 Graph of the band edge (Conducted)

GFSK (Bluetooth 4.2)

Lowest Channel



Highest Channel



6.5.6 Data of the band edge (Radiated)

Table 10 : Measured values of the band edge

Frequency [MHz]		Detect Mode	Polarization [V/H]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2 402	2 367.50	Peak	V	53.95	74.00	-20.05
	2 367.50	Average	V	31.84	54.00	-22.16
	2 389.71	Peak	H	54.16	74.00	-19.84
	2 389.71	Average	H	31.11	54.00	-22.89
2 480	2 491.58	Peak	V	54.03	74.00	-19.97
	2 491.58	Average	V	31.58	54.00	-22.42
	2 498.65	Peak	H	54.19	74.00	-19.81
	2 498.65	Average	H	31.04	54.00	-22.96

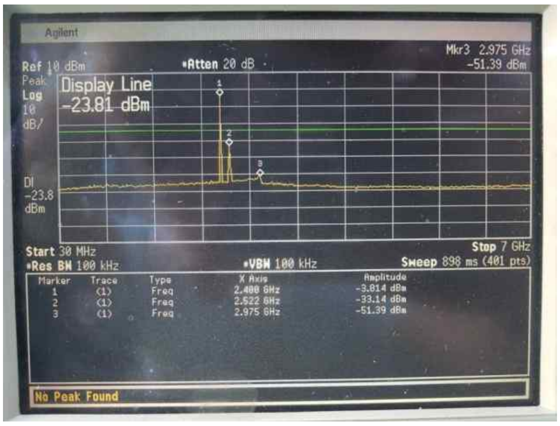
* Remark: "H" Horizontal, "V" Vertical

* **Margin [dB]** = Emission Level [dBμV/m] – Limit [dBμV/m]

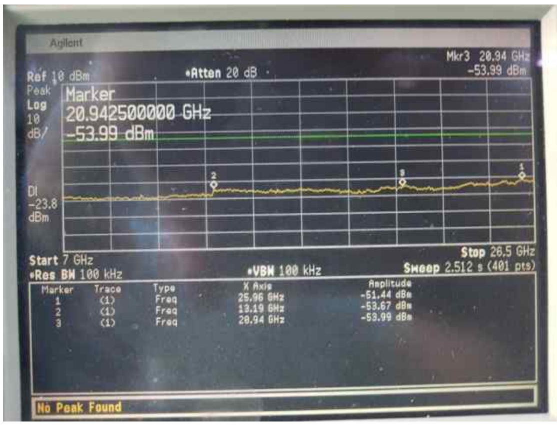
6.5.7 Graph of the spurious RF conducted emissions

GFSK (Bluetooth 4.2)

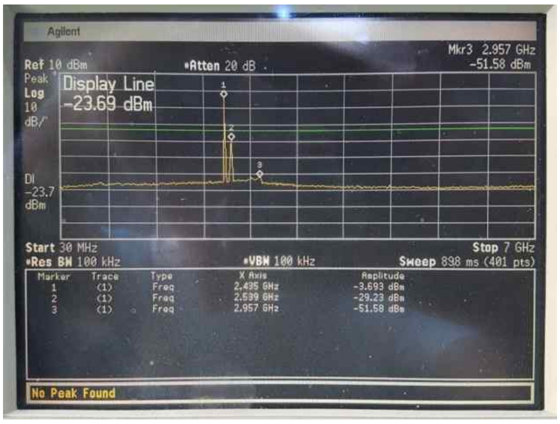
Lowest Channel: 30 MHz ~ 7 GHz



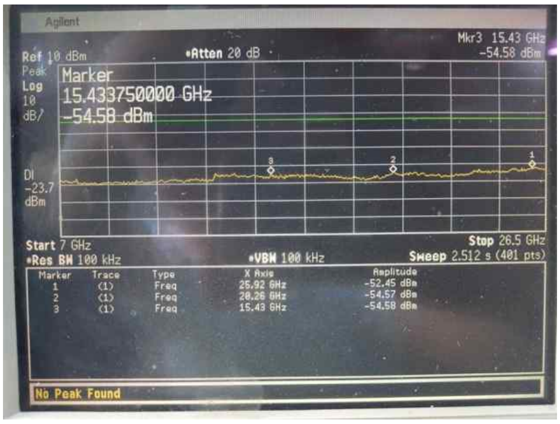
Lowest Channel: 7 GHz ~ 26 GHz



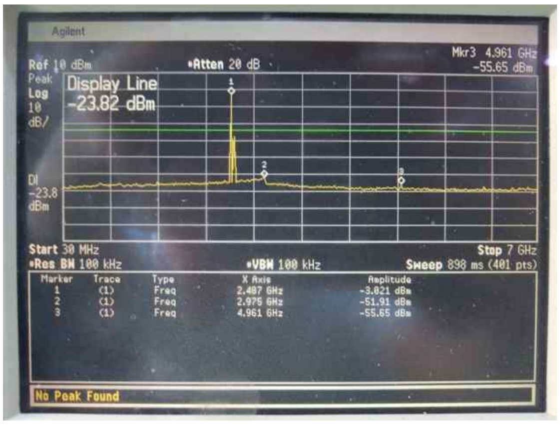
Middle Channel: 30 MHz ~ 7 GHz



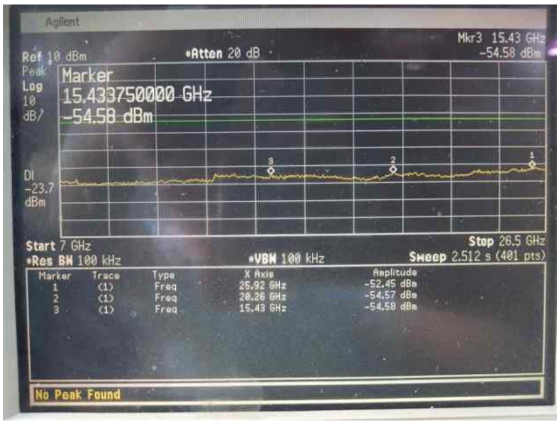
Middle Channel: 7 GHz ~ 26 GHz



Highest Channel: 30 MHz ~ 7 GHz



Highest Channel: 7 GHz ~ 26 GHz



6.6 AC power line conducted emissions

6.6.1 Regulation

According to §15.207(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 following table, as measured using a 50µH/50Ω 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 of emission [MHz]	Conducted limit [dBµV]	
	Qausi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

6.6.2 Test procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω / 50 µH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

6.6.3 Test Results: Pass

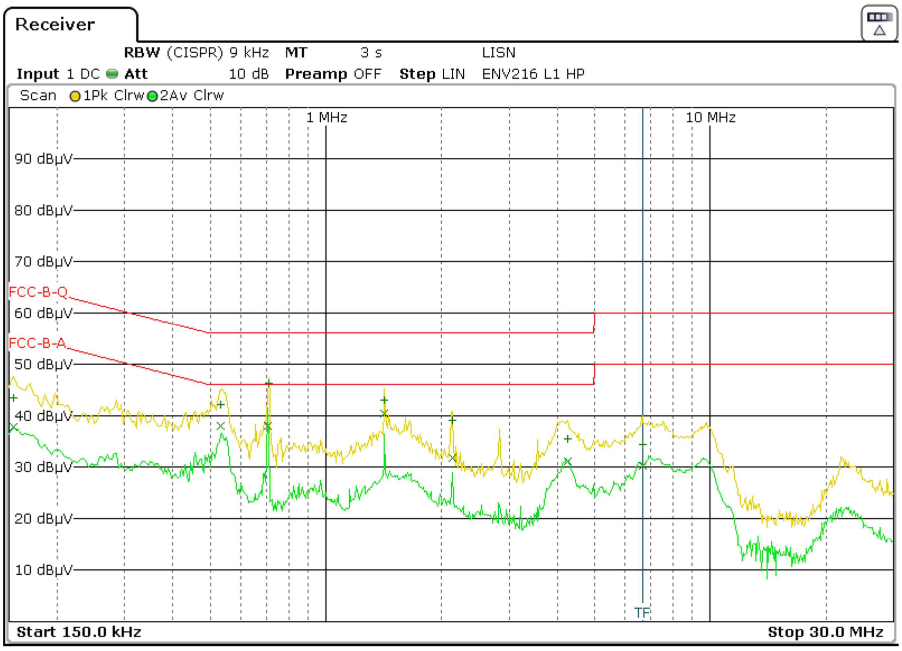
Table 13: Measured values of the DC Power Line Conducted Emissions

Frequency [MHz]	Factor		Line	Quasi-Peak			Average		
	LISN [dB]	Cable [dB]		Limit [dBμV]	Reading [dBμV]	Results [dBμV]	Limit [dBμV]	Reading [dBμV]	Results [dBμV]
0.15	9.69	0.15	P	66.00	33.74	43.58	56.00	28.03	37.87
0.53	9.81	0.14	P	56.00	32.49	42.44	46.00	28.20	38.15
0.71	9.77	0.15	N	56.00	36.54	46.46	46.00	28.46	38.38
1.42	9.64	0.17	P	56.00	33.29	43.10	46.00	30.61	40.42
2.13	9.61	0.18	P	56.00	29.37	39.16	46.00	22.06	31.85
4.26	9.61	0.20	P	56.00	25.64	35.45	46.00	21.41	31.22

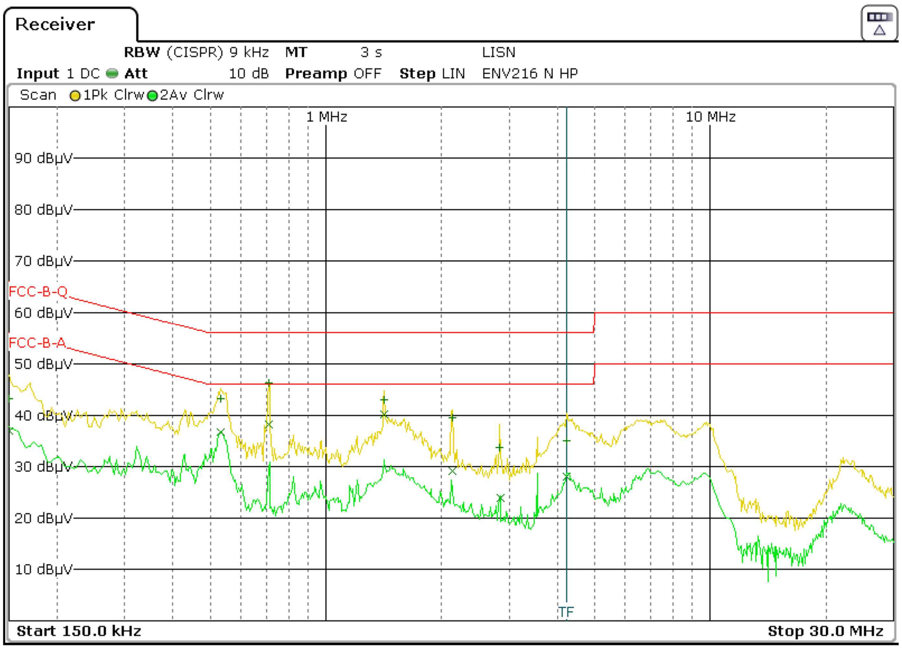
* Remark: “H”: Hot Line, “N”: Neutral Line

6.6.4 Plot of the ac power line conducted emissions

[Positive line]



[Negative line]



7. Radio Frequency Exposure

7.1 RF exposure limit

According to the FCC rule §1.1310, the limit for General Population/Uncontrolled exposure is 1 mW/cm² for the device operating 1 500 MHz ~ 100 000 MHz.

7.2 RF exposure consideration

This equipment should be operated with a minimum distance of 20 cm between the radiator and front of face.

This equipment should not be placed directly on the ear when the speaker is active.

7.3 EUT description

Kind of EUT	SMART TURNTABLE
Operating Frequency Band	□ Wireless Microphone: 494.000 MHz ~ 501.000 MHz and 498.200 MHz ~ 505.200 MHz □ WLAN(802.11b/g/n(HT20)): 2 412 MHz ~ 2 462 MHz □ WLAN(802.11n(HT40)): 2 422 MHz ~ 2 452 MHz □ WLAN: 5 180 MHz ~ 5 320 MHz / 5 500 MHz ~ 5 700 MHz □ WLAN: 5 745 MHz ~ 5 825 MHz ■ Bluetooth: 2 402 MHz ~ 2 480 MHz □ Zigbee: 2 425 MHz, 2 450 MHz, 2 475 MHz
Device Category	□ Portable (< 20 cm separation) □ Mobile (> 20 cm separation) ■ Others
Max. Output Power	-2.41 dBm
Used Antenna	Inserted into the bluetooth board (Chip Antenna)
Used Antenna Gain	1.9 dBi
Exposure Evaluation Applied	■ MPE □ SAR □ N/A

7.4 RF Exposure Evaluation

According to above equation, the following result was obtained.

Operating Freq. Band [MHz]	Operating Mode	Peak Output Power		Antenna Gain		Power Density [mW/cm²] @ 20 cm Separation	Limit [mW/cm²]
		[dBm]	[mW]	Log	Linear		
2 400 ~ 2 483.5	BLE	-2.41	0.57	1.90	1.55	0.000 18	1.00

$S = P * G / (4\pi * R^2) = 0.57 * 1.55 / (4 * 3.14 * 20^2) = 0.000\ 18$

Where:

S = Power Density,

P = Power input to the external antenna

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

8. Test Equipment Used For Test

Used	Description	Manufacturer	Model Name	Serial Number	Specifications	Next Cal. Data	Due Cal
■	Spectrum Analyzer	H.P	E4407B	US39010225	9 kHz ~ 26.5 GHz	2017-08-05	1 Year
■	Spectrum Analyzer	ROHDE & SCHWARZ	FSP13	100640	9 kHz ~ 13.6 GHz	2017-08-03	1 Year
■	Test Receiver	ROHDE & SCHWARZ	ESPI3	101171	9 kHz ~ 3 GHz	2017-08-03	1 Year
■	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESR7	101184	10 Hz ~ 7 GHz	2018-02-03	1 Year
■	BI-LOG ANT	SCHWARZBECK	VULB 9163	691	30 MHz ~ 1 GHz	2018-02-29	2 Years
■	Loop Antenna	EMCO	6502	9801-3191	9 kHz ~ 30 MHz	2018-02-04	2 Years
■	Horn antenna	Schwarzbeck	BBHA 9120D	769	1 GHz ~ 18 GHz	2017-10-29	2 Years
■	Horn antenna	Schwarzbeck	BBHA9170	BBHA9170178	18 GHz ~ 40 GHz	2018-11-02	2 Years
■	Amplifier	310N	291723	SONOMA	9 kHz ~ 1 GHz	2017-08-03	1 Year
■	Microwave Preamplifier	Agilent	8449B	3008A02014	1 GHz ~ 26.5 GHz	2018-02-02	1 Year
■	DC Source Meter	Maynuo	M8811	080010960011103 046	30 V 5 A	2017-08-03	1 Year
■	Two-Line V-Network	ROHDE & SCHWARZ	ENV216	3560.6550.12-101874-Rq	9 kHz ~ 30 MHz	2017-08-03	1 Year
□	EPM-P SERIES POWER METER	Agilent	E4416A	GB38272722	1 CH 100-240 VAC	2017-08-03	1 Year
□	Power Sensor	Agilent	8481A	US41030240	MAX.23 dBm AVG, 18 GHz	2017-08-03	1 Year
□	LISN/AMN	PMM	L3-32	1220X20311	32 A - 6 h	2017-08-03	1 Year
□	PULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	100059	0 MHz ~ 30 MHz	2018-02-02	1 Year