

Prüfbericht - Nr.: <i>Test Report No.:</i>	50262798 001	Auftrags-Nr.: <i>Order No.:</i>	180107821	Seite 1 von 25 Page 1 of 25
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2019.05.21	
Auftraggeber: <i>Client:</i>	LinHai Zhongtian Electronic Appliance Co., Ltd No.168, Yangqin River Road, Linhai, Zhejiang, China			
Prüfgegenstand: <i>Test item:</i>	Colorful Bluetooth Central Light			
Bezeichnung / Typ-Nr. : <i>Identification / Type No. :</i>	ZT-X-B1			
Auftrags-Inhalt: <i>Order content:</i>	TÜV Rheinland – FCC/IC Service			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15: Subpart C Section 15.207 FCC Part 15: Subpart C Section 15.209 FCC Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of receipt:</i>	2019.05.21			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A0000927782 005			
Prüfzeitraum: <i>Testing period:</i>	2020.06.29-2020.06.30			
Ort der Prüfung: <i>Place of testing:</i>	Refer to section 1.1.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
2020.12.28 Caidong Xie/PE 		2020.12.28 Feng Liang/TC 		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
Sonstiges/ Other: FCCID: 2AN8X-ZT-X-B1 Refer to report 60420089 001 for evaluation of radiated emission tests above 1GHz of BLE 4.2.				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery :</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
*Legende: 1= Sehr gut 2 = gut 3= befriedigend 4= ausreichend 5 = mangelhaft P(ass) =entspricht o.g. Prüfgrundlage(n) F(ail)= entspricht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T =nicht getestet Legend: 1= very good 2 = good 3= satisfactory 4= sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail)= failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>				

TEST SUMMARY

4.1.1 ANTENNA REQUIREMENT

Result:

Pass

4.1.2 6dB BANDWIDTH MEASUREMENT

Result:

Pass

4.1.3 MAXIMUM PEAK CONDUCTED OUTPUT POWER

Result:

Pass

4.1.4 PEAK POWER SPECTRAL DENSITY

Result:

Pass

4.1.5 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 kHz BANDWIDTH

Result:

Pass

4.1.6 CONDUCTED EMISSION (AC POWER-LINE)

Result:

Pass

4.1.7 RADIATED EMISSION

Result:

Pass

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1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC(Ningbo) Co., Ltd.

**1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road,
Zhenhai District, Ningbo 315200 P.R. China.**

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

No.	Equipment	Model	Inventory no.	Last cal. date	Cal. due date
1.	EMI test receiver	ESR7	101929	2020.11.25	2021.11.11
2.	Spectrum analyzer	FSV40	101412	2020.11.25	2021.11.11
3.	Pre-amplifier	SCU-18F	180051	2020.11.25	2021.11.11
4.	Bilog Antenna	CBL6112D	49033	2018.11.06	2021.04.12

1.3 Measurement Uncertainty

Test Item	Expanded Measurement Uncertainty (k=2)
Conducted Emission (9-150kHz)	3.70dB
Conducted Emission (150k-30MHz)	3.30dB
Radiated Emission (30-1000MHz)	4.39dB
Radiated Emission (1-18GHz)	4.67dB

2 General Product Information

2.1 Product Function and Intended Use

The EUT(equipment under test) is a Colorful Bluetooth Central Light which support Bluetooth function operated at 2400-2483.5MHz. For the further information, refer to the user's manual.

Model list:

Model name	Input voltage	Rated power	Function
ZT-X-B1	DC 3.7V	6W	Bluetooth V4.2(dual mode)

BT LE V4.2 has been evaluated in this report.

2.2 Ratings and System Details

Rated input : DC 3.7V
Protection Class : III
FCC ID : 2AN8X-ZT-X-B1

Technical Specification of BLE

Technical Specification	BLE
Operating Frequency band	2402 – 2480MHz
Bluetooth Core Version	Bluetooth Low Energy 4.2
Channel separation	2MHz
Extreme Temperature Range	-20°C ~ 60°C
Modulation	GFSK
Data Rate	1Mbps
Antenna Type	PIFA Antenna
Antenna Gain(dBi)	3.3
Channel	0~39

2.3 Independent Operation Modes

The basic operation modes are:

Mode A: Transmitting continuously in a channel

Mode B: adaptor operation for Transmitting and Receiving

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit diagram for further information.

2.5 Submitted Documents

Circuit diagram, PCB layout, Labels, user's manual, etc.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The Mode Cs were adapted accordingly in reference to the instructions for use.

3.2 Test Operation and Test Software

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software EMC32 V10.30 was used in the radiated emission test.

3.3 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.
notebook	Lenovo	T420

3.4 Countermeasures to achieve EMC Compliance

The tested sample contained noise suppression components as specified in the circuit diagram. No special measure is employed to achieve the requirement.

3.5 Test set-up

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

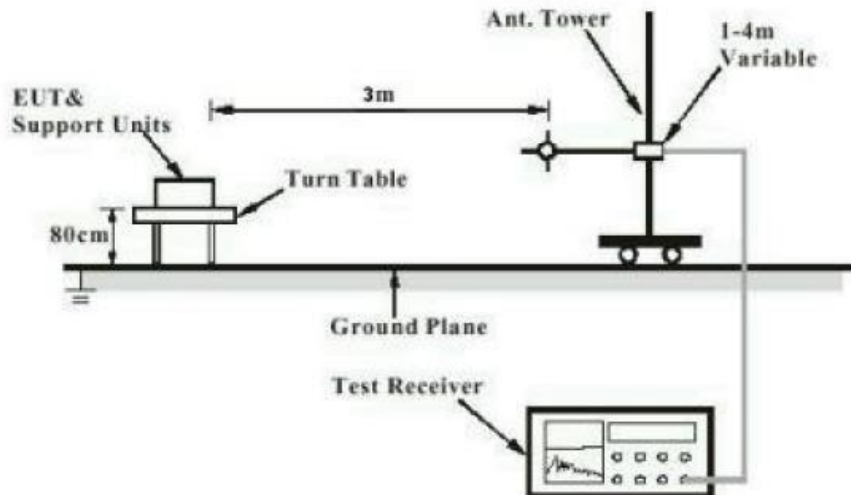


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

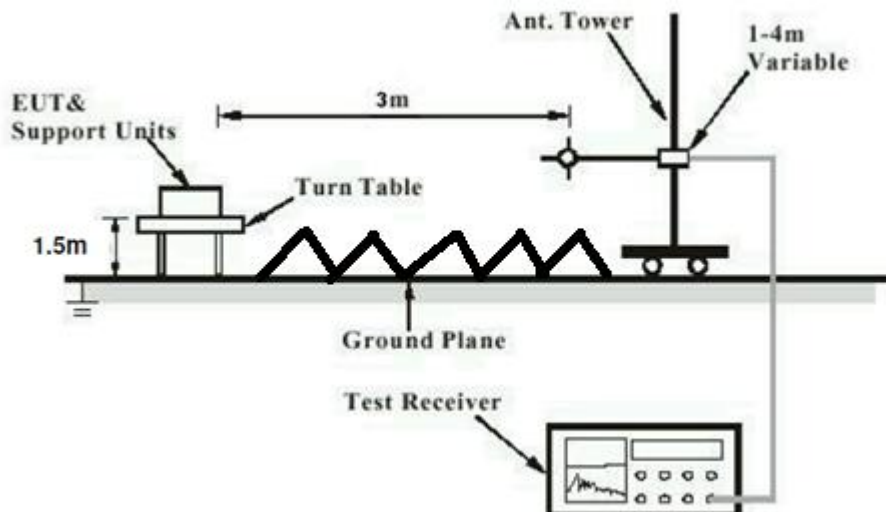
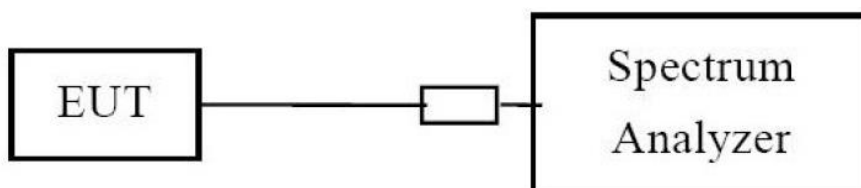


Diagram of Measurement Configuration for Conducted Transmitter Measurement



4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

Result:

Pass

Test Specification
Test standard : FCC Part 15.203

The EUT has an internal antennas, which permanently attached and no consideration of replacement. Therefore, the EUT is considered sufficient to comply with the provision. Refer to EUT Photo for further details.

4.1.2 6dB Bandwidth Measurement

Result:

Pass

Test Specification

Test standard : FCC Part 15.247 (a)(2)
Basic standard : ANSI C63.10: 2013
Limits : At least 500kHz
Kind of test site : Shielded Room

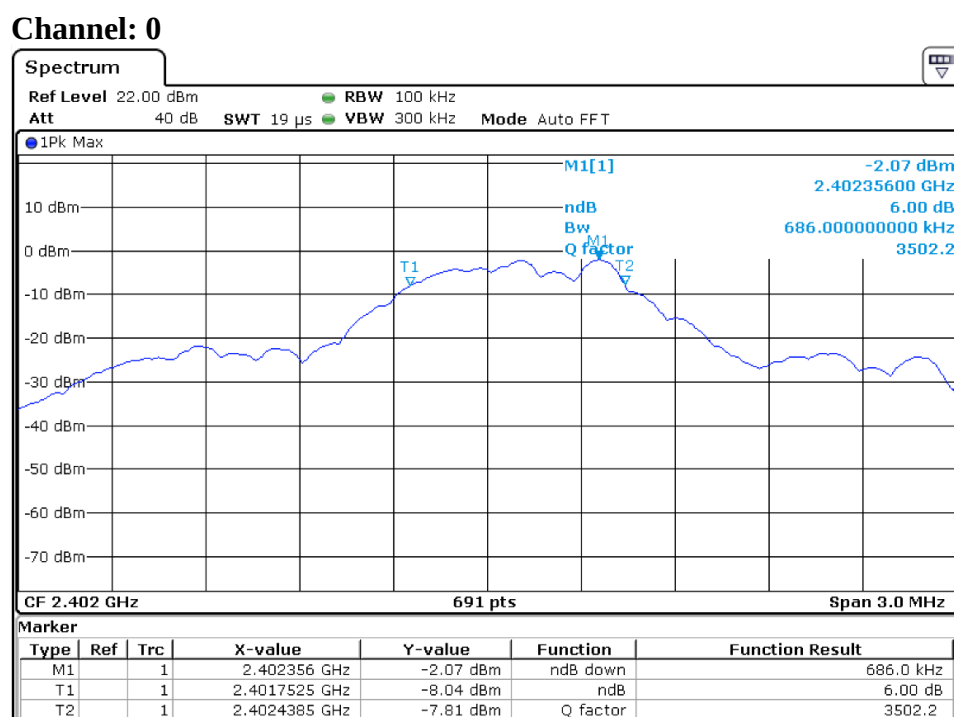
Test Setup

Date of testing : 2020.06.29
Input voltage : DC 3.7V
Operational mode : Mode A
Test channel : Lo, Mi, Hi
Temperature : 24°C
Relative humidity : 55%
Atmospheric pressure : 101.2 kPa

Table 2: Test result of 6dB Bandwidth for BLE

Channel	Channel Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	686.0	500	Pass
Mid Channel	2440	668.6	500	Pass
High Channel	2480	664.3	500	Pass

Figure 1: 6dB Bandwidth Measurement



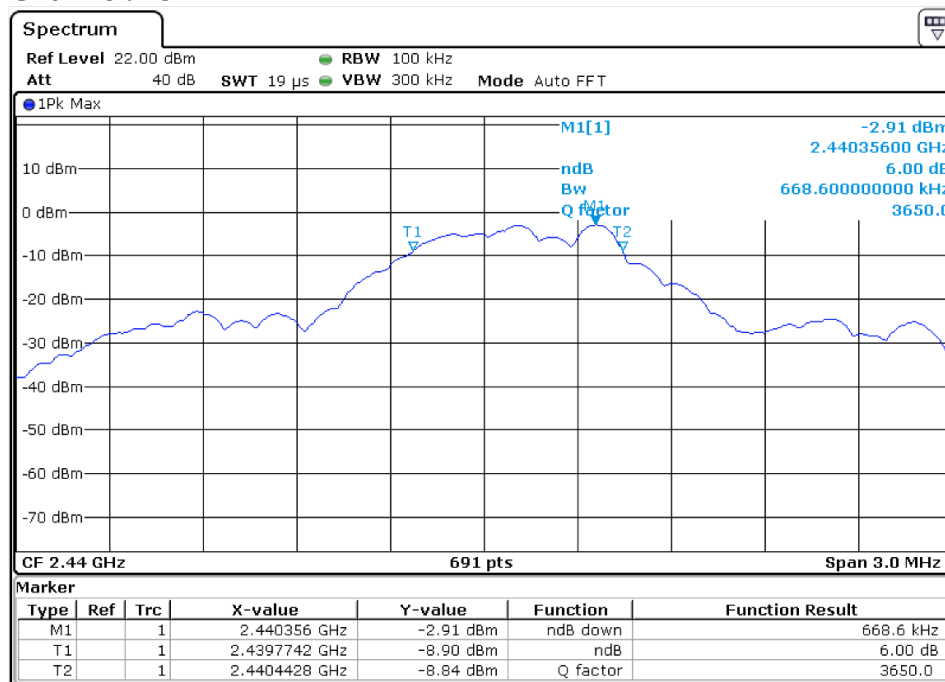
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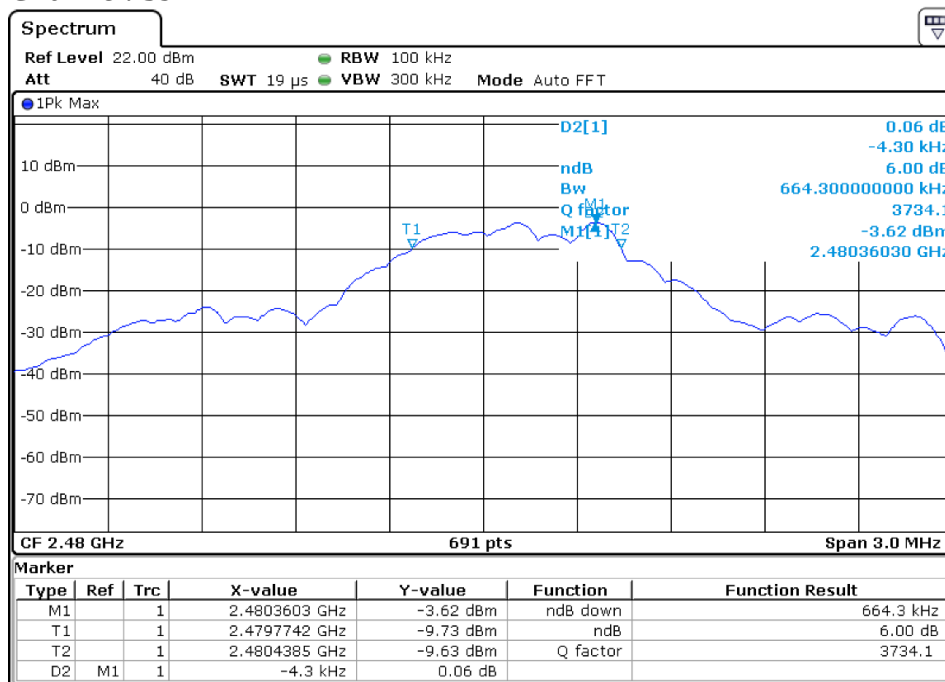
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Channel: 19



Channel: 39



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4.1.3 Maximum Peak Conducted Output Power

Result:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(3)
Basic standard : ANSI C63.10: 2013
Limits : Not more than 1Watt(30dBm)
Kind of test site : Shielded Room

Test Setup

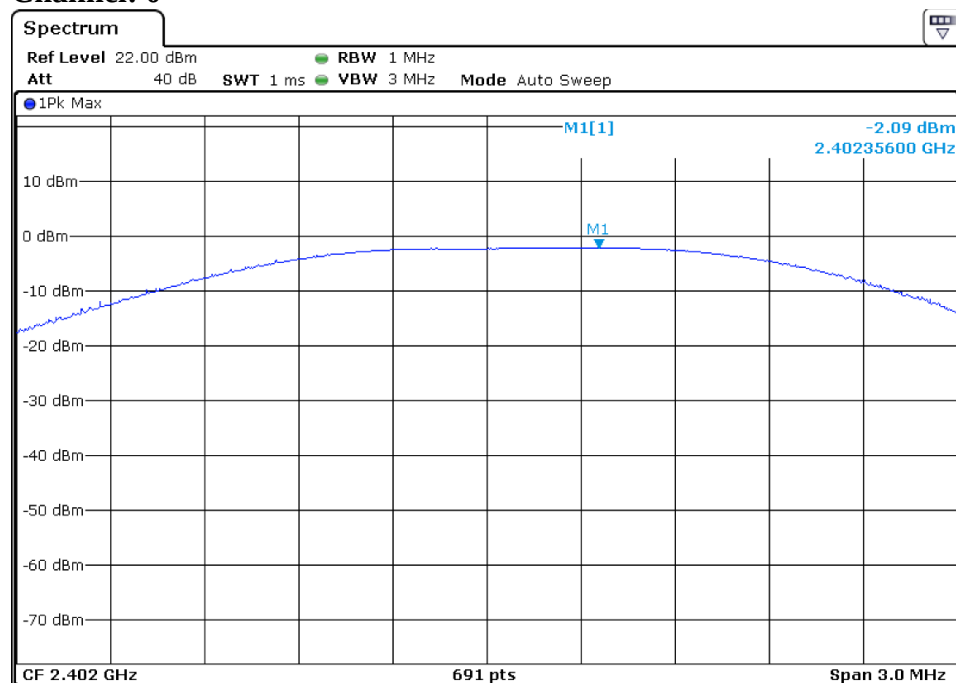
Date of testing : 2020.06.29
Input voltage : DC 3.7V
Operational mode : Mode A
Test channel : Lo, Mi, Hi
Temperature : 24 °C
Relative humidity : 55%
Atmospheric pressure : 101.2 kPa

Table 3: Test result of Maximum Peak Output Power

Channel	Channel Frequency (MHz)	Peak Output Power(dBm)	Limit (dBm)
Low Channel	2402	-2.09	30
Mid Channel	2440	-2.80	30
High Channel	2480	-3.66	30

Figure 2: Maximum peak Conducted Output Power

Channel: 0



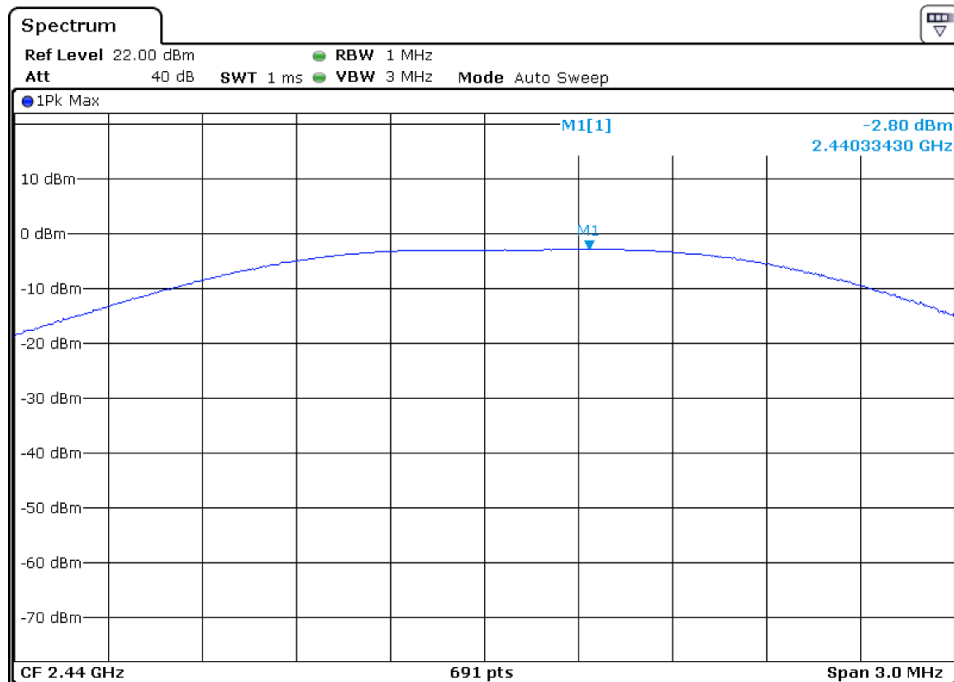
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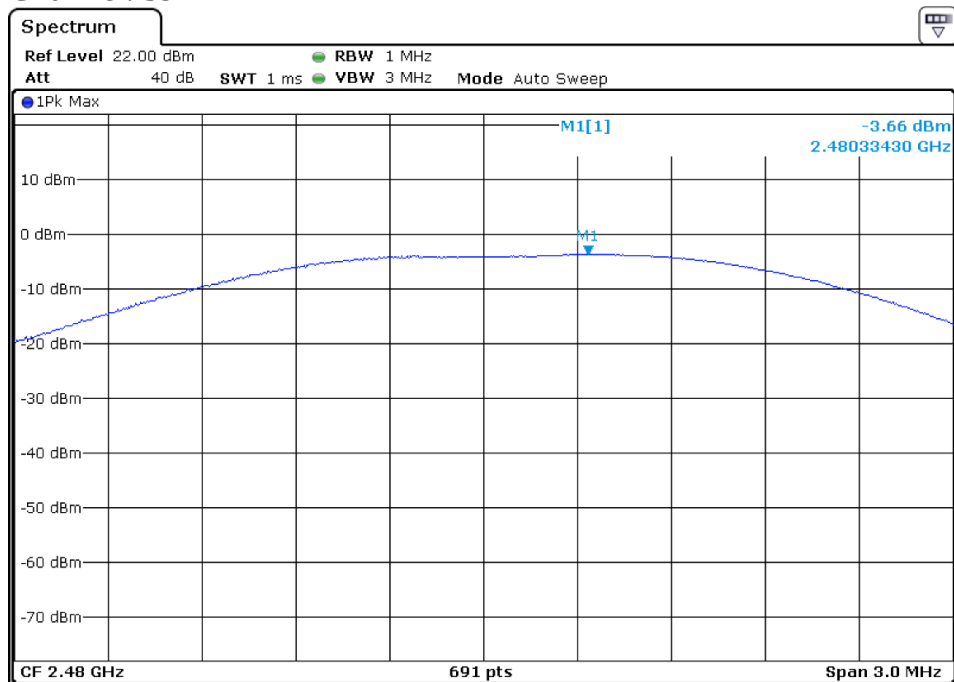
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Channel: 19



Channel: 39



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4.1.4 Peak Power Spectral Density

Result:

Pass

Test Specification

Test standard : FCC Part 15.247(e)
Basic standard : ANSI C63.10: 2013
Limits : Not more than 8 dBm in any 3 kHz band
Kind of test site : Shielded Room

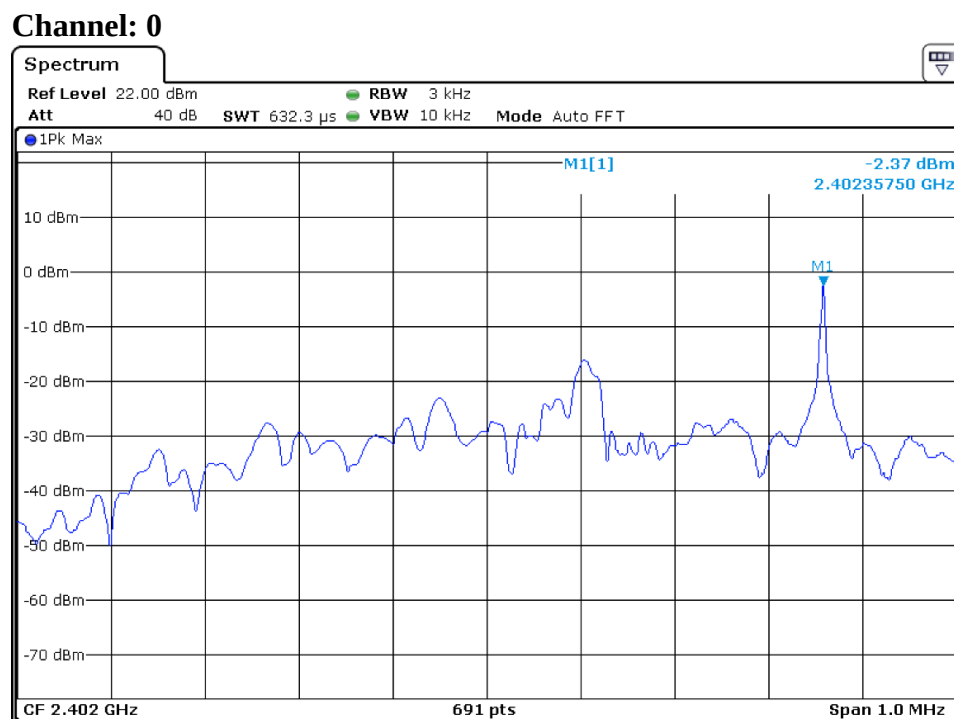
Test Setup

Date of testing : 2020.06.29
Input voltage : DC 3.7V
Operational mode : Mode A
Test channel : Lo, Mi, Hi
Temperature : 24°C
Relative humidity : 55%
Atmospheric pressure : 101.2 kPa

Table 4: Test result of Power Spectral Density

Channel	Channel Frequency(MHz)	Measured Power Density (dBm)	Limit (dBm)	Result
Low Channel	2402	-2.37	8.0	Pass
Mid Channel	2440	-2.97	8.0	Pass
High Channel	2480	-3.83	8.0	Pass

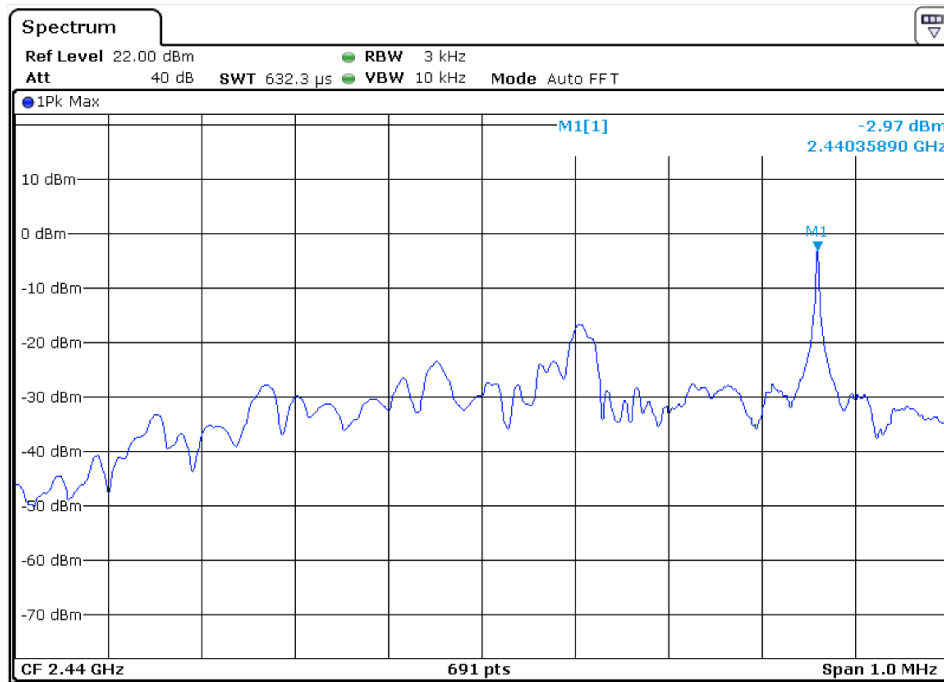
Figure 3: Power Spectral Density



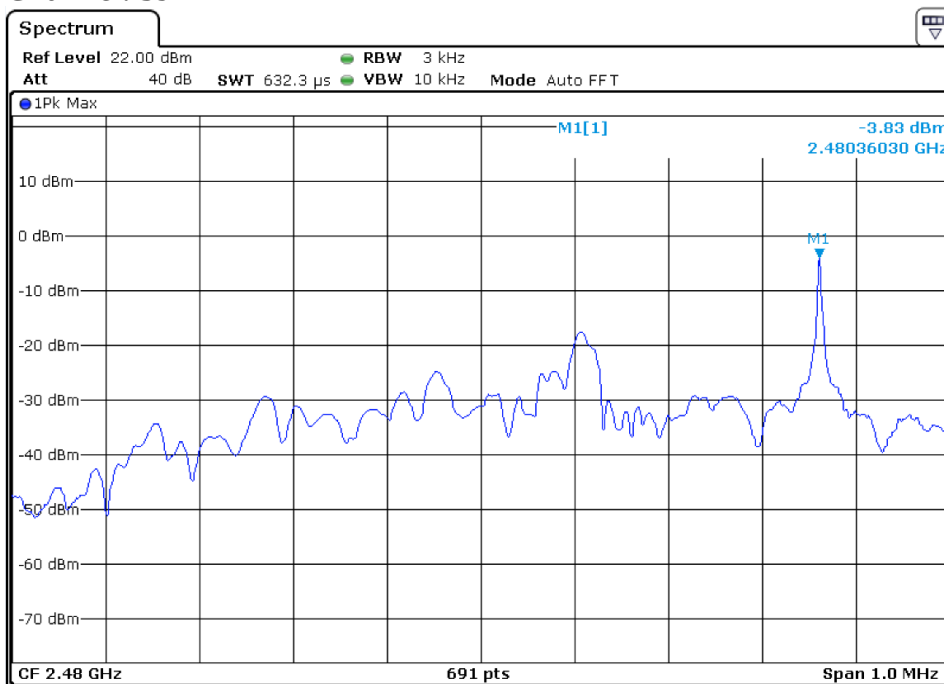
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Channel: 19



Channel: 39



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4.1.5 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

Result:

Pass

Test Specification

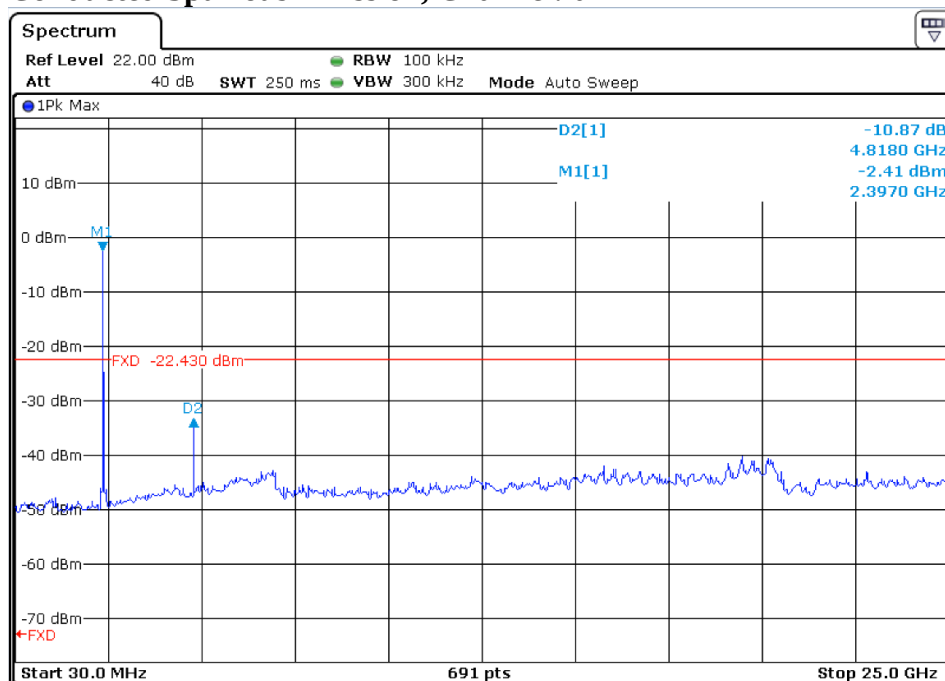
Test standard : FCC Part 15.247(d)
Basic standard : ANSI C63.10: 2013
Limits : 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);
Kind of test site : Shielded Room

Test Setup

Date of testing : 2020.06.29
Input voltage : DC 3.7V
Operational mode : Mode A
Test channel : Lo, Mi, Hi
Temperature : 24°C
Relative humidity : 55%
Atmospheric pressure : 101.2 kPa

Figure 4: Conducted Spurious Emission

Conducted Spurious Emission, Channel: 0



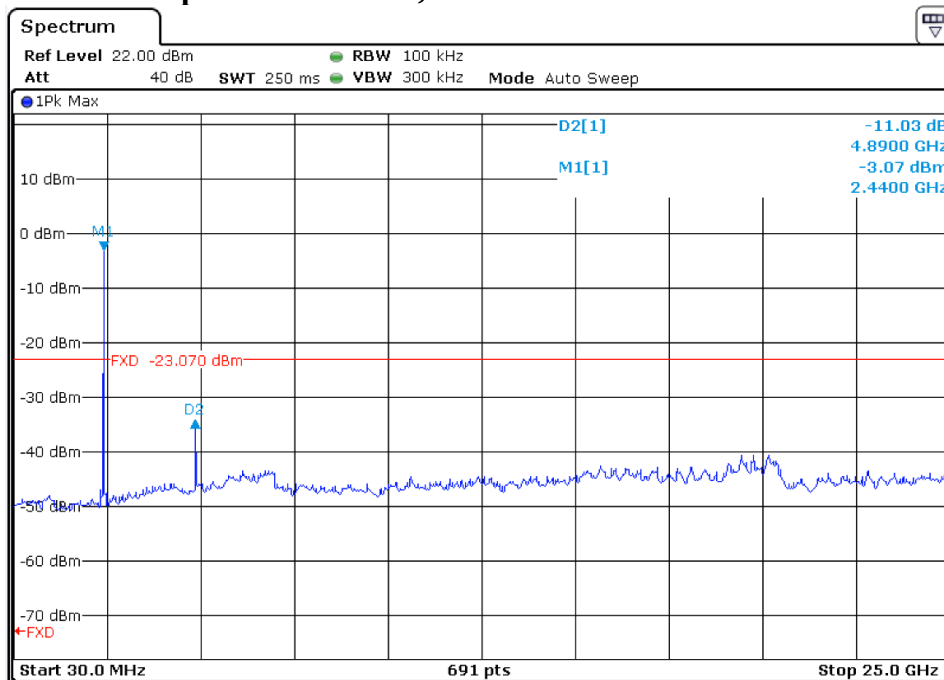
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Test Report No.:

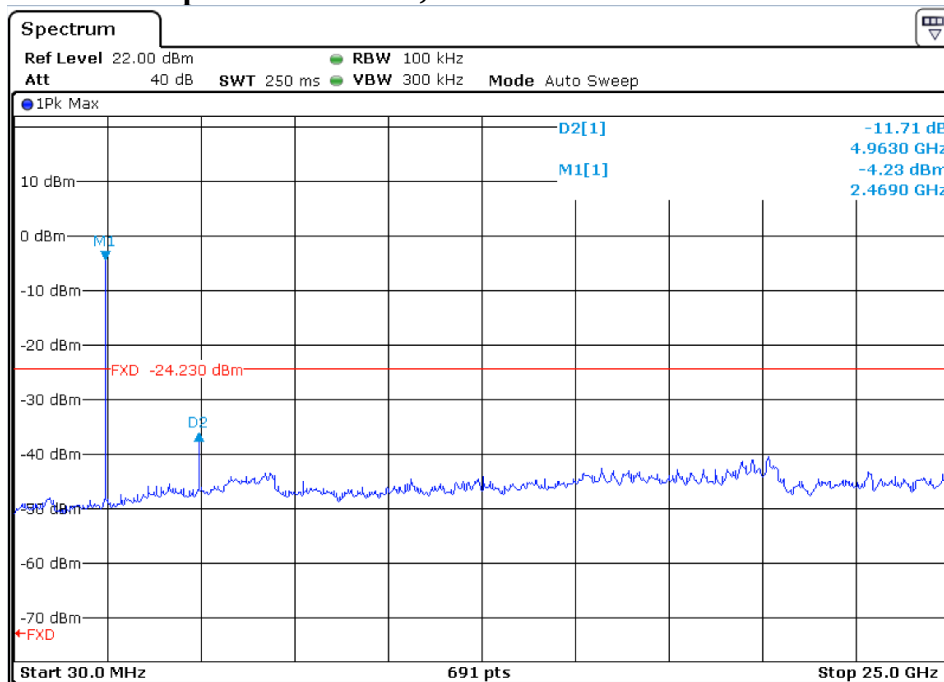
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Conducted Spurious Emission, Channel: 19



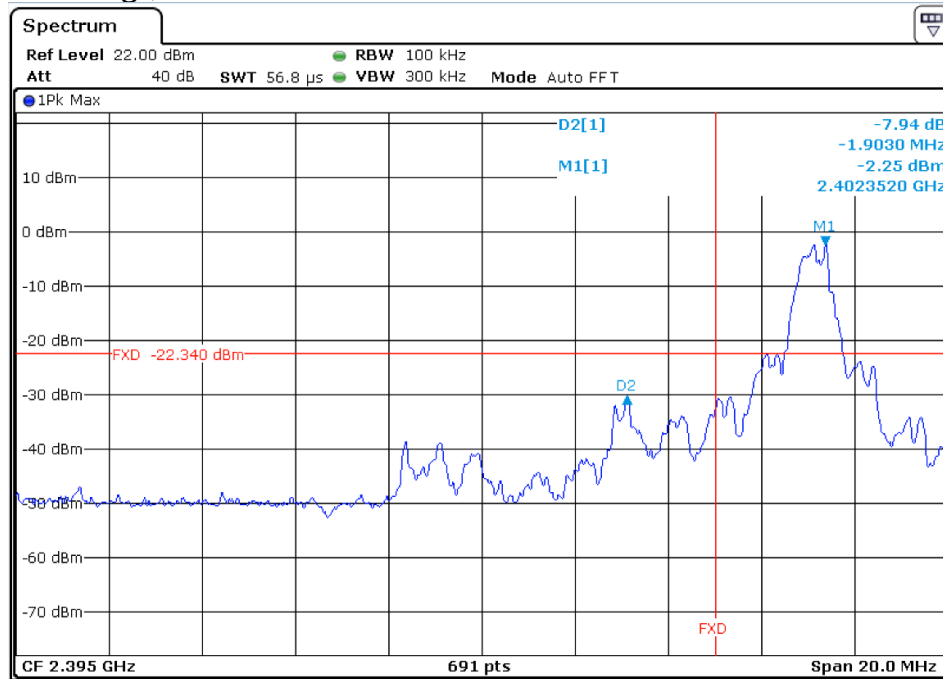
Conducted Spurious Emission, Channel: 39



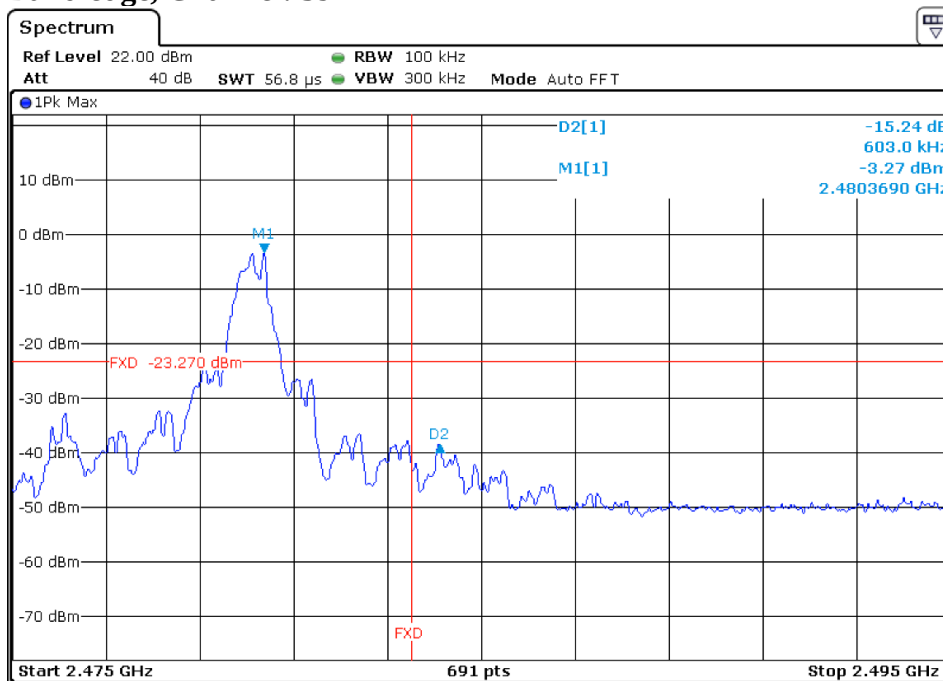
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Band edge, Channel: 0



Band edge, Channel: 39



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4.1.6 Conducted Emission (AC power-line)

Result:

Pass

Test Specification	
Test standard	: FCC Part 15.207
Basic standard	: ANSI C63.10: 2013, clause 6.2
Port	: Mains
Frequency range	: 0.15 – 30MHz
Limits	: FCC part 15.207(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2020.06.29
Adaptor Input voltage	: AC 120V, 60Hz
Operational mode	: Mode B
Temperature	: 24°C
Relative humidity	: 55%
Atmospheric pressure	: 102.1 kPa

The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction (LISN factor + cable loss).

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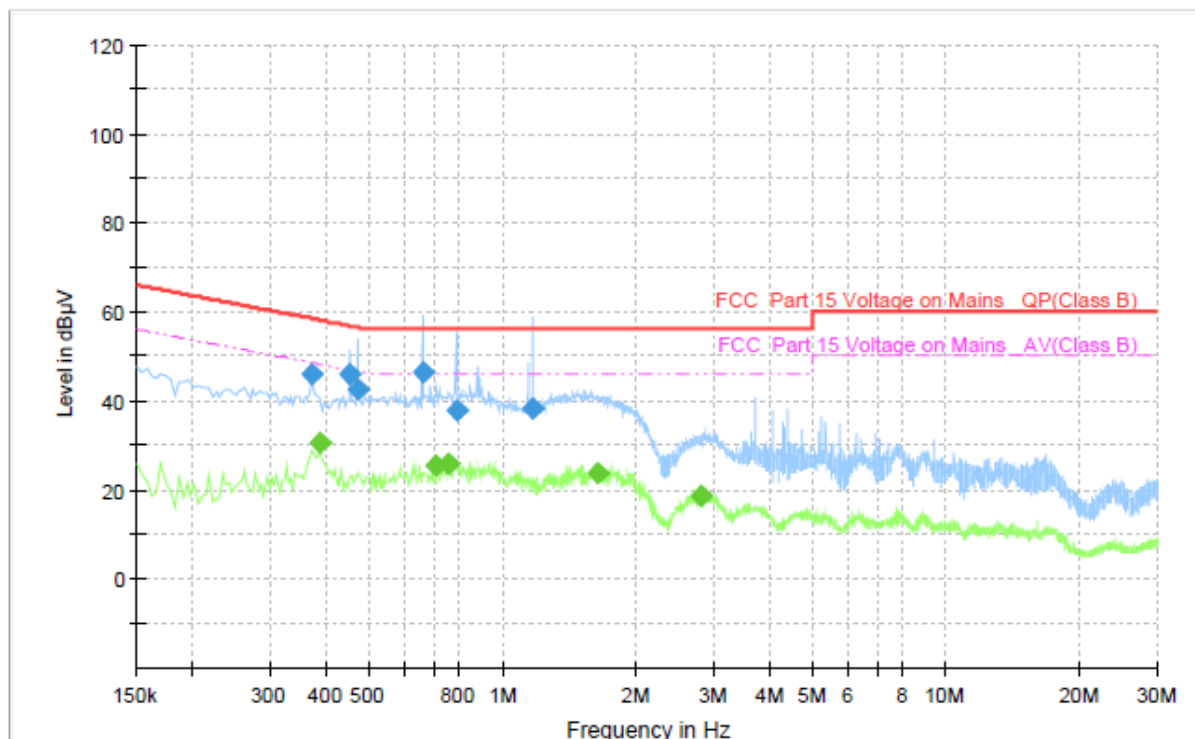
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Figure 5: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, L

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.370000	45.98	---	58.50	12.52	1000.0	9.000	L1	ON	9.5
0.390000	---	30.60	48.06	17.46	1000.0	9.000	L1	ON	9.5
0.454000	45.96	---	56.80	10.84	1000.0	9.000	L1	ON	9.5
0.470000	42.66	---	56.51	13.86	1000.0	9.000	L1	ON	9.5
0.662000	46.43	---	56.00	9.57	1000.0	9.000	L1	ON	9.5
0.710000	---	25.56	46.00	20.44	1000.0	9.000	L1	ON	9.5
0.758000	---	25.78	46.00	20.22	1000.0	9.000	L1	ON	9.5
0.786000	37.61	---	56.00	18.39	1000.0	9.000	L1	ON	9.5
1.170000	38.21	---	56.00	17.79	1000.0	9.000	L1	ON	9.5
1.638000	---	23.87	46.00	22.13	1000.0	9.000	L1	ON	9.6
2.818000	---	18.44	46.00	27.56	1000.0	9.000	L1	ON	9.6

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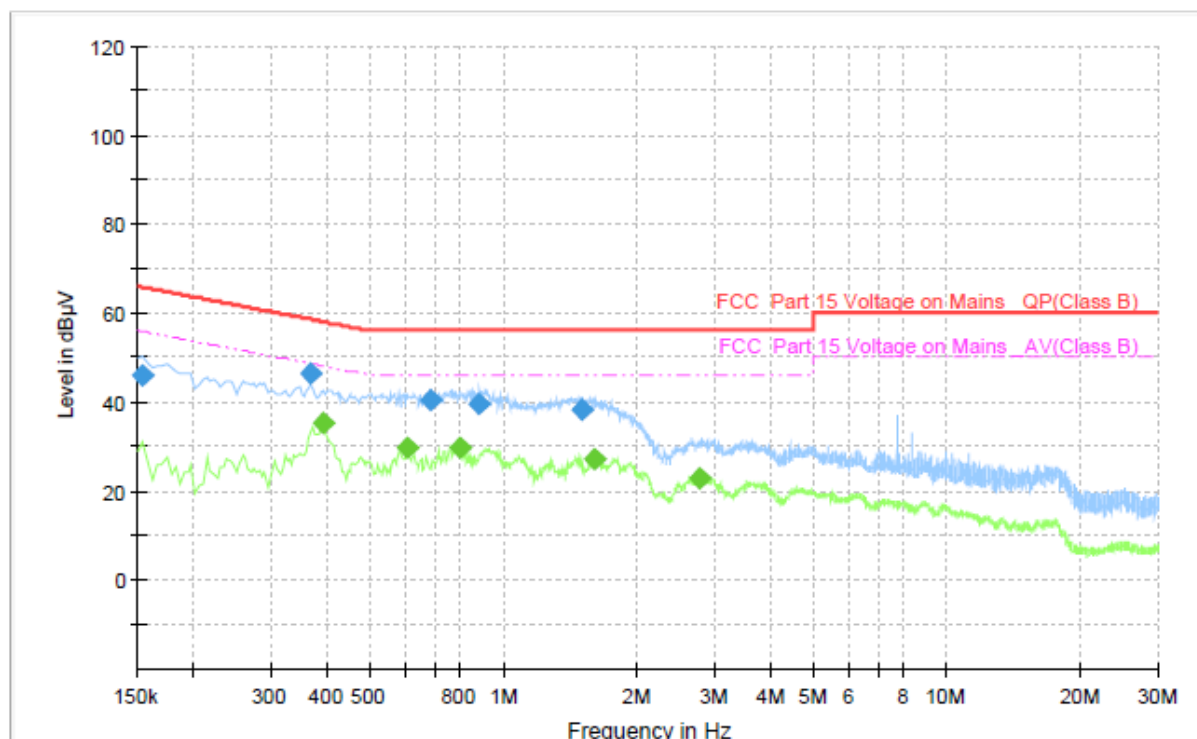
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Figure 6: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, N

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154000	46.02	---	65.78	19.76	1000.0	9.000	N	ON	9.6
0.366000	46.41	---	58.59	12.18	1000.0	9.000	N	ON	9.5
0.394000	---	35.10	47.98	12.88	1000.0	9.000	N	ON	9.5
0.606000	---	29.54	46.00	16.46	1000.0	9.000	N	ON	9.5
0.682000	40.56	---	56.00	15.44	1000.0	9.000	N	ON	9.5
0.798000	---	29.68	46.00	16.32	1000.0	9.000	N	ON	9.5
0.882000	39.64	---	56.00	16.36	1000.0	9.000	N	ON	9.5
1.502000	38.20	---	56.00	17.80	1000.0	9.000	N	ON	9.6
1.610000	---	27.22	46.00	18.78	1000.0	9.000	N	ON	9.6
2.770000	---	22.63	46.00	23.37	1000.0	9.000	N	ON	9.6

4.1.7 Radiated Emission

Result:

Pass

Test Specification	
Test standard	: FCC Part 15.209
Basic standard	: ANSI C63.10: 2013
Port	: Enclosure
Frequency range	: 30MHz-1000MHz
Limits	: FCC part15.209(a)
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2020.06.30
Input voltage	: DC 3.7V
Operational mode	: Mode A
Test channel	: Lo, Mi, Hi
Temperature	: 22°C
Relative humidity	: 55%
Atmospheric pressure	: 101 kPa

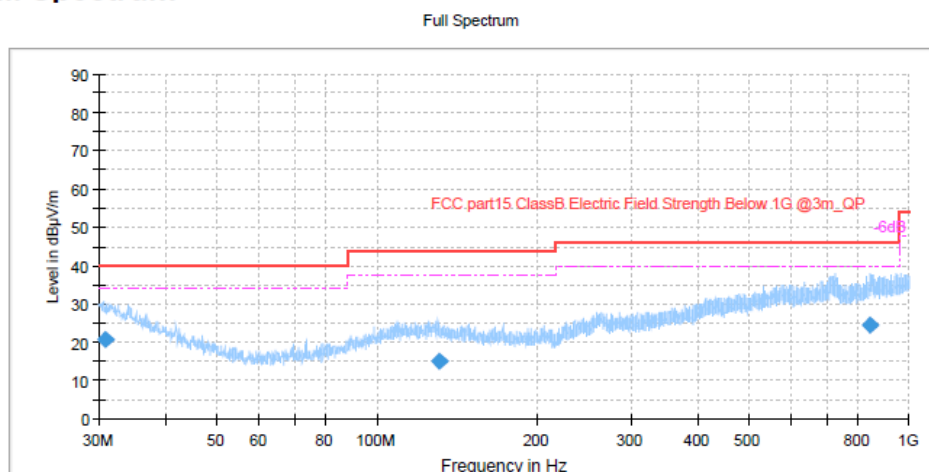
Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case emissions configuration of the each mode were reported.

The measurement result is calculated based on the following formula by the test software:

Emission Level = Reading level + Correction (Antenna factor + Cable loss – Preamplifier)

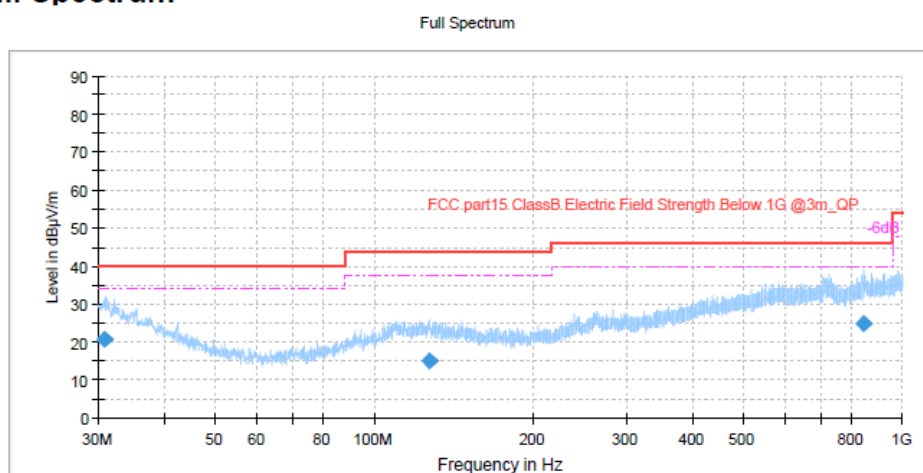
Figure 7: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Horizontal, Channel 0 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.812778	20.85	40.00	19.15	1000.0	120.000	143.0	H	35.0	24.9
130.588889	15.03	43.50	28.47	1000.0	120.000	150.0	H	276.0	18.9
845.737778	24.62	46.00	21.38	1000.0	120.000	154.0	H	33.0	29.5

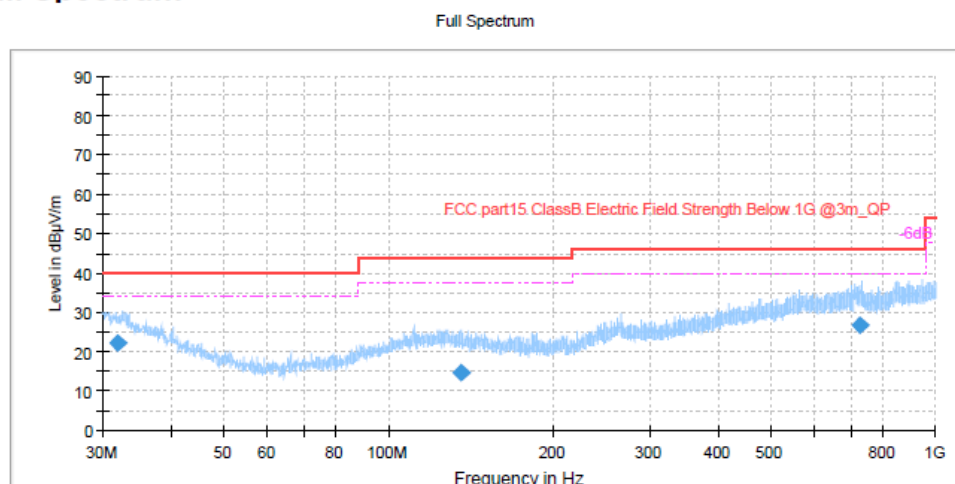
Figure 8: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Vertical, Channel 0 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.885556	20.73	40.00	19.27	1000.0	120.000	167.0	V	72.0	24.9
127.369444	15.09	43.50	28.41	1000.0	120.000	246.0	V	233.0	19.1
844.863333	24.73	46.00	21.27	1000.0	120.000	219.0	V	230.0	29.5

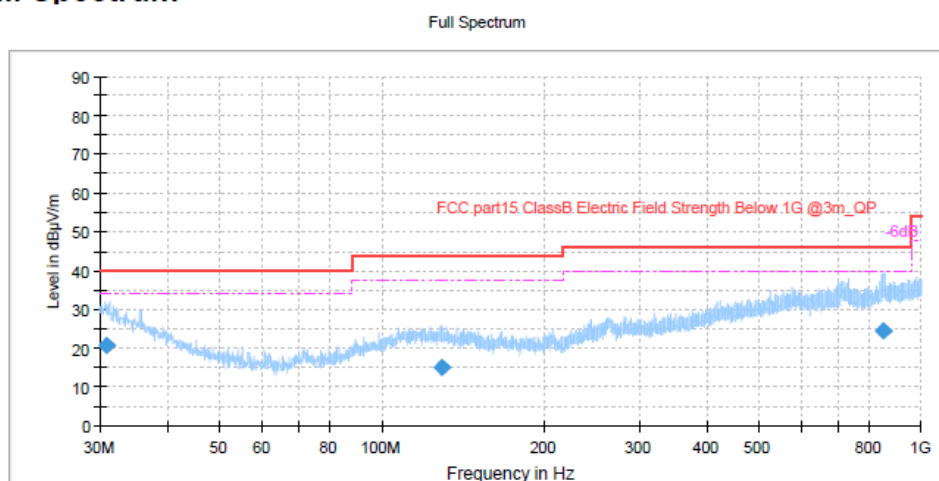
Figure 9: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Horizontal, Channel 19 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.984444	22.32	40.00	17.68	1000.0	120.000	104.0	H	16.0	24.3
135.482222	14.81	43.50	28.69	1000.0	120.000	164.0	H	80.0	18.7
729.608889	26.84	46.00	19.16	1000.0	120.000	250.0	H	104.0	28.1

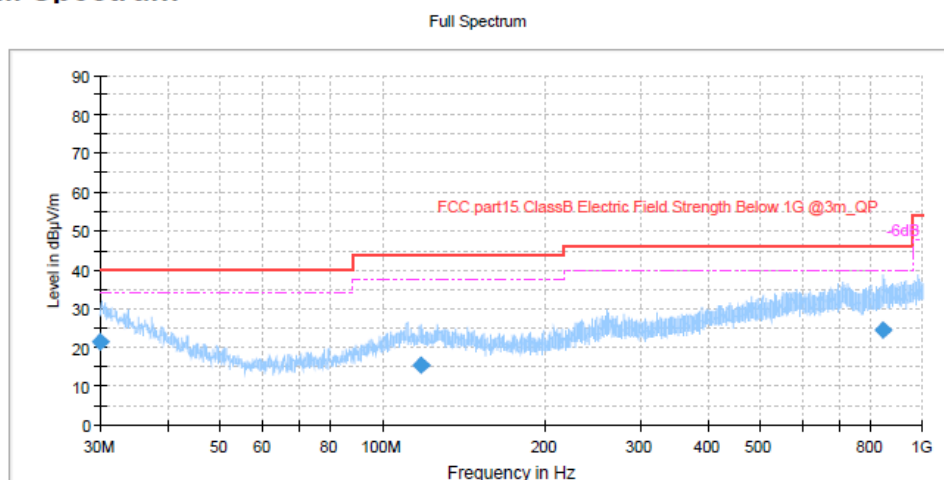
Figure 10: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Vertical, Channel 19 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.936111	20.78	40.00	19.22	1000.0	120.000	150.0	V	125.0	24.8
129.537222	15.13	43.50	28.37	1000.0	120.000	219.0	V	249.0	19.0
852.553889	24.54	46.00	21.46	1000.0	120.000	130.0	V	0.0	29.4

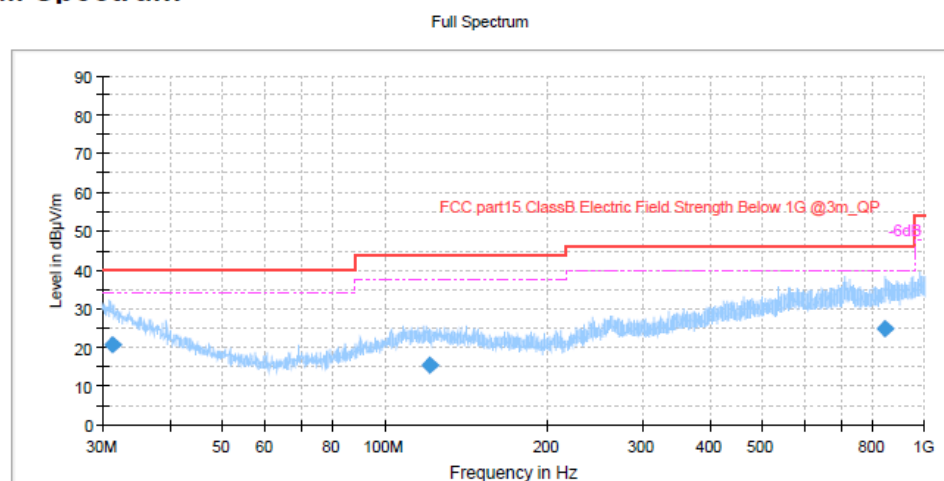
Figure 11: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Horizontal, Channel 39 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.080000	21.41	40.00	18.59	1000.0	120.000	120.0	H	349.0	25.2
117.577222	15.49	43.50	28.01	1000.0	120.000	124.0	H	312.0	19.3
845.023333	24.62	46.00	21.38	1000.0	120.000	111.0	H	215.0	29.2

Figure 12: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, Vertical, Channel 39 Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.323889	20.56	40.00	19.44	1000.0	120.000	100.0	V	42.0	24.6
121.429444	15.34	43.50	28.16	1000.0	120.000	250.0	V	246.0	19.4
845.576111	24.73	46.00	21.27	1000.0	120.000	187.0	V	273.0	29.5

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