TEST REPORT

No. I20N03227-BLE

for

HMD Global Oy

Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

Model Name: TA-1351

with

Hardware Version: 99652_1_11

Software Version: 000T_0_080

FCC ID: 2AJOTTA-1351

Issued Date: 2021-01-18

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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1. Summary of Test Report

1.1. Test Items

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	TA-1351
Applicant's name	HMD Global Oy
Manufacturer's Name	HMD Global Oy

1.2. Test Standards

FCC Part15-2019; ANSI C63.10-2013

1.3. Test Result

Pass

1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China

1.5. Project data

Testing Start Date:	2020-12-15
Testing End Date:	2021-01-15

1.6. Signature

Lin Zechuang

(Prepared this test report)

Tang Weisheng

(Reviewed this test report)

Zhang Bojun

(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 902600 Espoo，Finland
Contact Person	Rosario Casillo
E-Mail	Rosario Casillo@hmdglobal.com
Telephone:	/
Fax:	/

2.2. Manufacturer Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 902600 Espoo，Finland
Contact Person	Rosario Casillo
E-Mail	Rosario Casillo@hmdglobal.com
Telephone:	/
Fax:	/

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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	TA-1351
Frequency Range	2400MHz~2483.5MHz
Type of Modulation	GFSK
Number of Channels	40
Antenna Type	Integrated
Antenna Gain	2.2dBi
Power Supply	3.85V DC by Battery
FCC ID	2AJOTTA-1351
Condition of EUT as received	No abnormality in appearance

Note1: According to the customer's description, TA-1351 is a variant of TA-1334. The difference between them is that the TA-1334 supports dual SIM, while the TA-1351 only supports single SIM. This difference does not affect the following test cases. All results were from the initial model. The initial model report number is I20N03225-BLE.

Note2: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Shenzhen Academy of Information and Communications Technology.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Receive Date
UT07aa	358742570000034	99652_1_11	000T_0_080	2020-12-07
UT12aa	358742570001730	99652_1_11	000T_0_080	2020-12-15
UT13aa	358742570007408	99652_1_11	000T_0_080	2020-12-15

*EUT ID: is used to identify the test sample in the lab internally.

UT07aa is used for conduction test, UT12aa is used for radiation test, and UT13aa is used for AC Power line Conducted Emission test.

3.3. Internal Identification of AE used during the test

AE ID*	Description	AE ID*
AE1	Battery	/
AE2	Charger	/
AE3	Data Cable	/
AE4	Headset	/

AE1

Model	WT340
Manufacturer	Guangdong Fenghua New Energy Co.,Ltd
Capacity	4900mAh
Nominal Voltage	3.85V

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AE2-1

Model	PA-US5V2A-036
Manufacturer	Yutong Electronics(Huizhou) Co., Ltd

AE2-2

Model	CH-21U
Manufacturer	Shenzhen Tianyin Electronics Co., Ltd

AE3-1

Model	CB-36A
Manufacturer	ShenZhen BRL Technology Co., Ltd

AE3-2

Model	CB-36A
Manufacturer	Huizhou Washin Electronics co.,LTD

AE4

Model	HS-34
Manufacturer	New Leader Industry Co.,Ltd

*AE ID: is used to identify the test sample in the lab internally.

3.4. General Description

The Equipment under Test (EUT) is a model of Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN with integrated antenna and battery.

It consists of normal options: Lithium Battery, Charger, USB Cable and Headset.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

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4. Reference Documents

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz	2019
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013

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5. Test Results

5.1. Testing Environment

Normal Temperature: 15~35˚C

Relative Humidity: 20~75%

5.2. Test Results

No	Test cases	Sub-clause of Part 15C	Verdict
0	Antenna Requirement	15.203	**P**
1	Maximum Peak Output Power	15.247 (b)	**P**
2	Peak Power Spectral Density	15.247 (e)	**P**
3	Occupied 6dB Bandwidth	15.247 (a)	**P**
4	Band Edges Compliance	15.247 (d)	**P**
5	Transmitter Spurious Emission - Conducted	15.247 (d)	**P**
6	Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	**P**
7	AC Power line Conducted Emission	15.107, 15.207	**P**

See **ANNEX A** for details.

5.3. Statements

SAICT has evaluated the test cases requested by the applicant/manufacturer as listed in section 5.2 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

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6. Test Equipments Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2021-12-30	1 year
2	Test Receiver	ESCI	100701	Rohde & Schwarz	2021-08-09	1 year
3	LISN	ENV216	102067	Rohde & Schwarz	2021-07-16	1 year

Radiated emission test system

NO.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Loop Antenna	HLA6120	35779	TESEQ	2022-04-25	3 years
2	BiLog Antenna	3142E	00224831	ETS-Lindgren	2021-05-17	3 years
3	Horn Antenna	3117	00066577	ETS-Lindgren	2022-04-02	3 years
4	Test Receiver	ESR7	101676	Rohde & Schwarz	2021-11-25	1 year
5	Spectrum Analyser	FSV40	101192	Rohde & Schwarz	2022-01-13	1 year
6	Chamber	FACT3-2.0	1285	ETS-Lindgren	2021-07-19	2 years
7	Antenna	QSH-SL-1 8-26-S-20	17013	Q-par	2023-01-06	3 years
8	Amplifier	SCU-18D	5600190430	Rohde & Schwarz	/	/

Test software

No.	Equipment	Manufacturer	Version
1	TechMgr Software	CAICT	2.1.1
2	EMC32	Rohde & Schwarz	8.53.0
3	EMC32	Rohde & Schwarz	10.01.00

EUT is engineering software provided by the customer to control the transmitting signal.
The EUT was programmed to be in continuously transmitting mode.

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren

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7. Laboratory Environment

Semi-anechoic chambe

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Normalised site attenuation (NSA)	< ±4 dB, 3 m distance, from 30 to 1000 MHz

Shielded room

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-1000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio （VSWR）	≤ 6 dB, from 1 to 18 GHz， 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

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8. Measurement Uncertainty

Test Name	Uncertainty (*k*=2)	
1. Maximum Peak Output Power	1.32dB	
2. Peak Power Spectral Density	2.32dB	
3. 6dB Bandwidth	66Hz	
4. Band Edges Compliance	1.92dB	
5. Transmitter Spurious Emission - Conducted	30MHz≤f<1GHz	1.41dB
	1GHz≤f<7GHz	1.92dB
	7GHz≤f<13GHz	2.31dB
	13GHz≤f≤26GHz	2.61dB
6. Transmitter Spurious Emission - Radiated	9kHz≤f<30MHz	1.74dB
	30MHz≤f<1GHz	4.84dB
	1GHz≤f<18GHz	4.68dB
	18GHz≤f≤40GHz	3.76dB
7. AC Power line Conducted Emission	150kHz≤f≤30MHz	3.00dB
8. 99% Occupied Bandwidth	66Hz	

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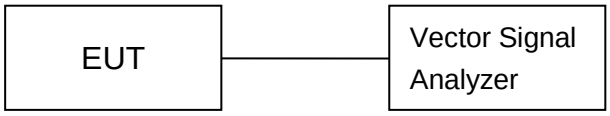
ANNEX A: Detailed Test Results

Test Configuration

The measurement is made according to ANSI C63.10.

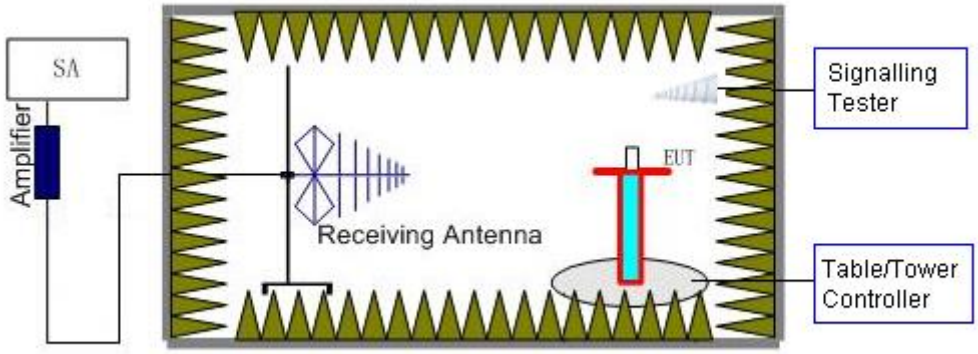
1) Conducted Measurements

1. Connect the EUT to the test system correctly.
2. Set the EUT to the required work mode.
3. Set the EUT to the required channel.
4. Set the spectrum analyzer to start measurement.
5. Record the values.



2) Radiated Measurements

Test setup: EUT was placed on a 1.5 meter high non-conductive table at a 3 meter test distance from the receive antenna. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiving antenna polarization.



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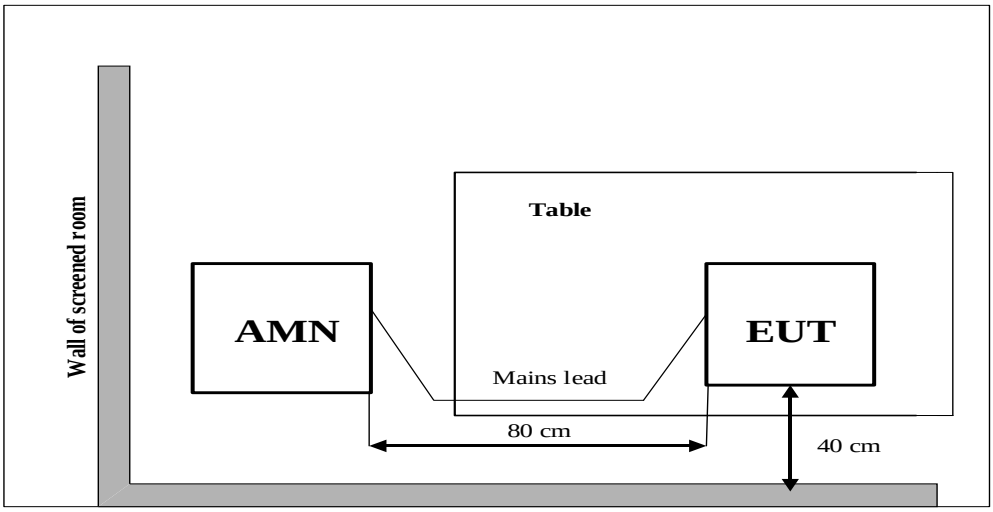
3) AC Power line Conducted Emission Measurement

For Bluetooth LE, the EUT is working under test mode. The EUT is commanded to operate at maximum transmitting power.



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A.0 Antenna requirement

Measurement Limit:

Standard	Requirement
FCC CRF Part 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Conclusion: The Directional gains of antenna used for transmitting is 2.2 dBi.
The RF transmitter uses an integrate antenna without connector.

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A.1 Maximum Peak Output Power

Method of Measurement: See ANSI C63.10-clause 11.9.1.3

The maximum peak conducted output power may be measured using a broadband peak RF power meter.

Measurement Limit:

Standard	Limit (dBm)
FCC 47 CRF Part 15.247(b)	< 30

Measurement Results:

Mode	Frequency (MHz)	Peak Conducted Output Power（dBm）	Conclusion
LE 1M	2402(CH0)	-3.81	**P**
	2440(CH19)	-2.81	**P**
	2480(CH39)	-2.43	**P**
LE 2M	2402(CH0)	-3.86	**P**
	2440(CH19)	-2.83	**P**
	2480(CH39)	-2.46	**P**

Conclusion: Pass

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A.2 Peak Power Spectral Density

Method of Measurement: See ANSI C63.10-clause 11.10.2

Measurement Limit:

Standard	Limit
FCC 47 CRF Part 15.247(e)	< 8 dBm/3 kHz

Measurement Results:

Mode	Frequency (MHz)	Peak Power Spectral Density（dBm）		Conclusion
LE 1M	2402(CH0)	Fig.1	-20.69	**P**
	2440(CH19)	Fig.2	-19.80	**P**
	2480(CH39)	Fig.3	-19.61	**P**
LE 2M	2402(CH0)	Fig.4	-23.41	**P**
	2440(CH19)	Fig.5	-22.55	**P**
	2480(CH39)	Fig.6	-22.30	**P**

See below for test graphs.
Conclusion: PASS

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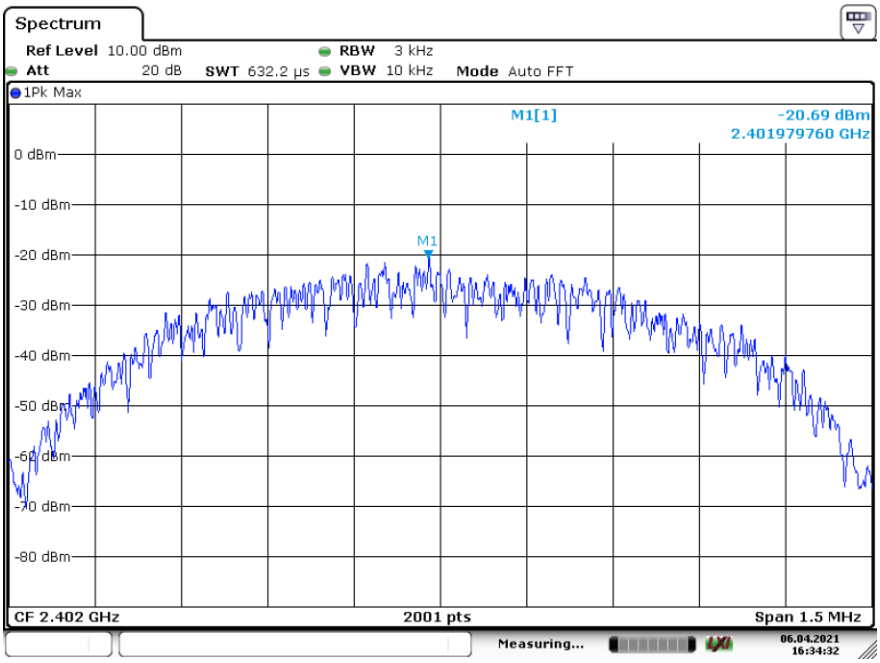

Fig.1 Power Spectral Density (Ch 0), LE 1M

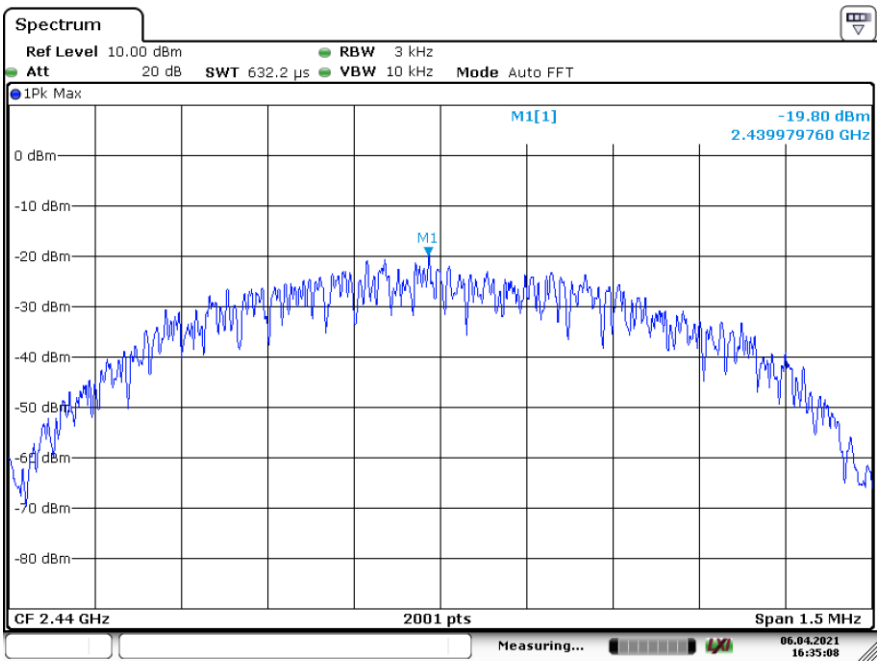

Fig.2 Power Spectral Density (Ch 19), LE 1M

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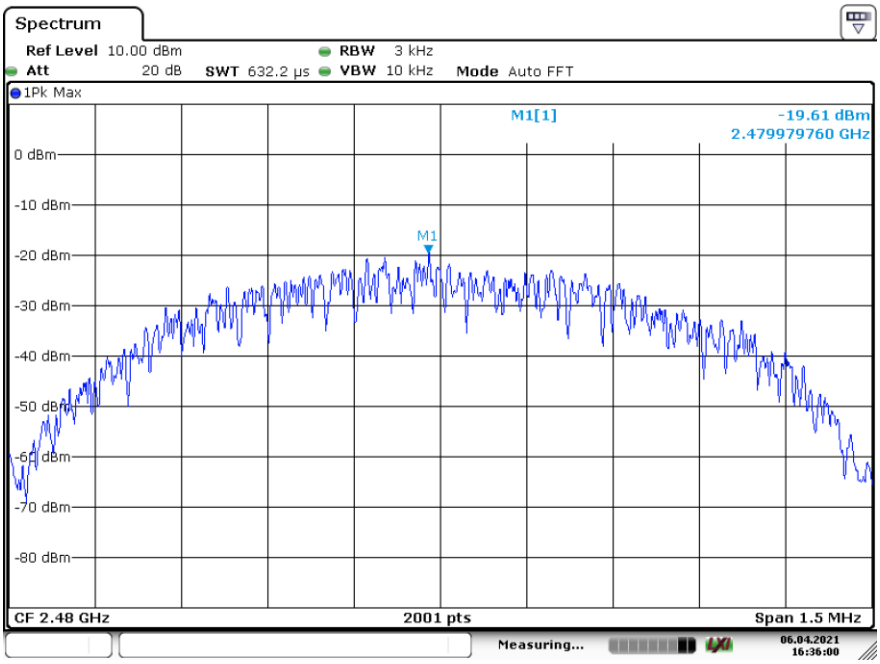

Fig.3 Power Spectral Density (Ch 39), LE 1M

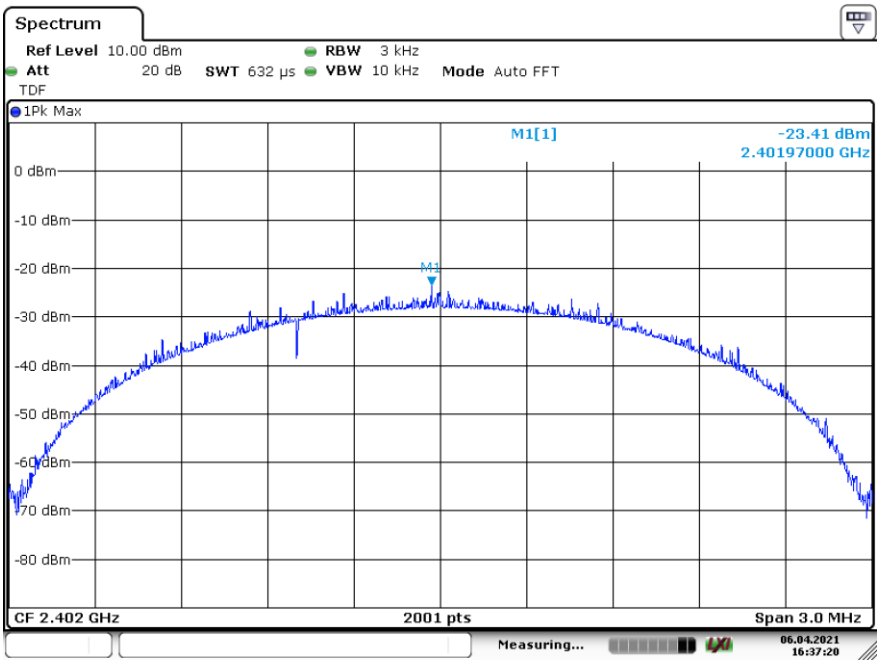

Fig.4 Power Spectral Density (Ch 0), LE 2M

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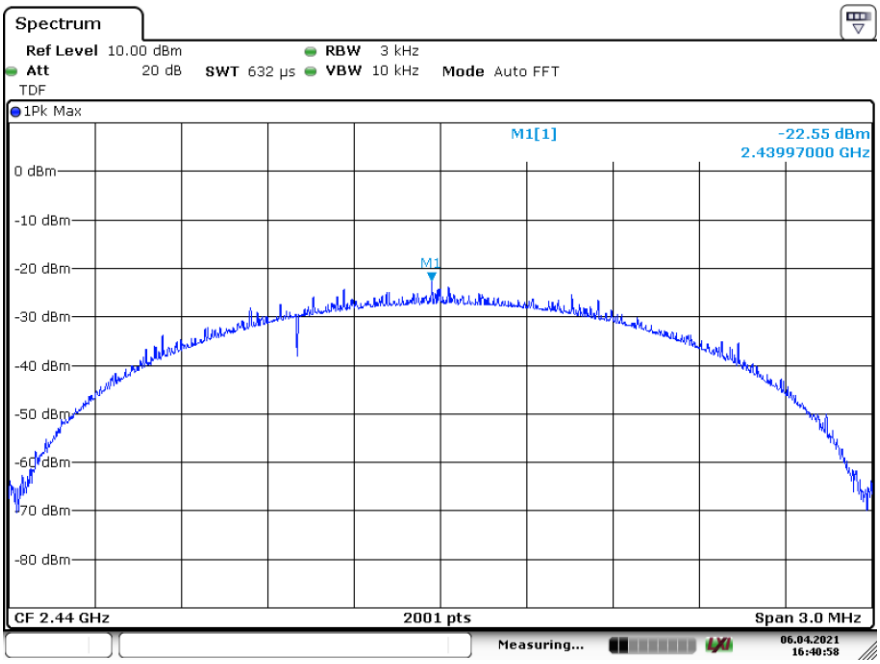

Fig.5 Power Spectral Density (Ch 19), LE 2M

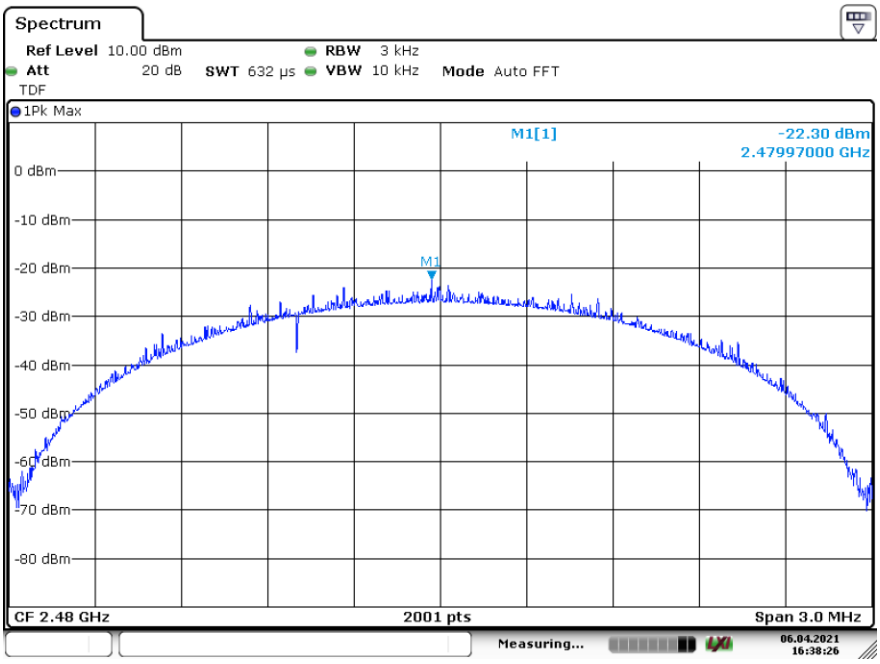

Fig.6 Power Spectral Density (Ch 39), LE 2M

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A.3 6dB Bandwidth

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.247 (a)	≥ 500

Measurement Result:

Mode	Frequency (MHz)	Test Results (kHz)		Conclusion
LE 1M	2402(CH0)	Fig.7	665.00	**P**
	2440(CH19)	Fig.8	666.00	**P**
	2480(CH39)	Fig.9	665.50	**P**
LE 2M	2402(CH0)	Fig.10	1162.50	**P**
	2440(CH19)	Fig.11	1163.50	**P**
	2480(CH39)	Fig.12	1165.50	**P**

See below for test graphs.

Conclusion: PASS

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Fig.7 6dB Bandwidth (Ch 0), LE 1M

Fig.8 6dB Bandwidth (Ch 19), LE 1M

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Fig.9 6dB Bandwidth (Ch 39), LE 1M

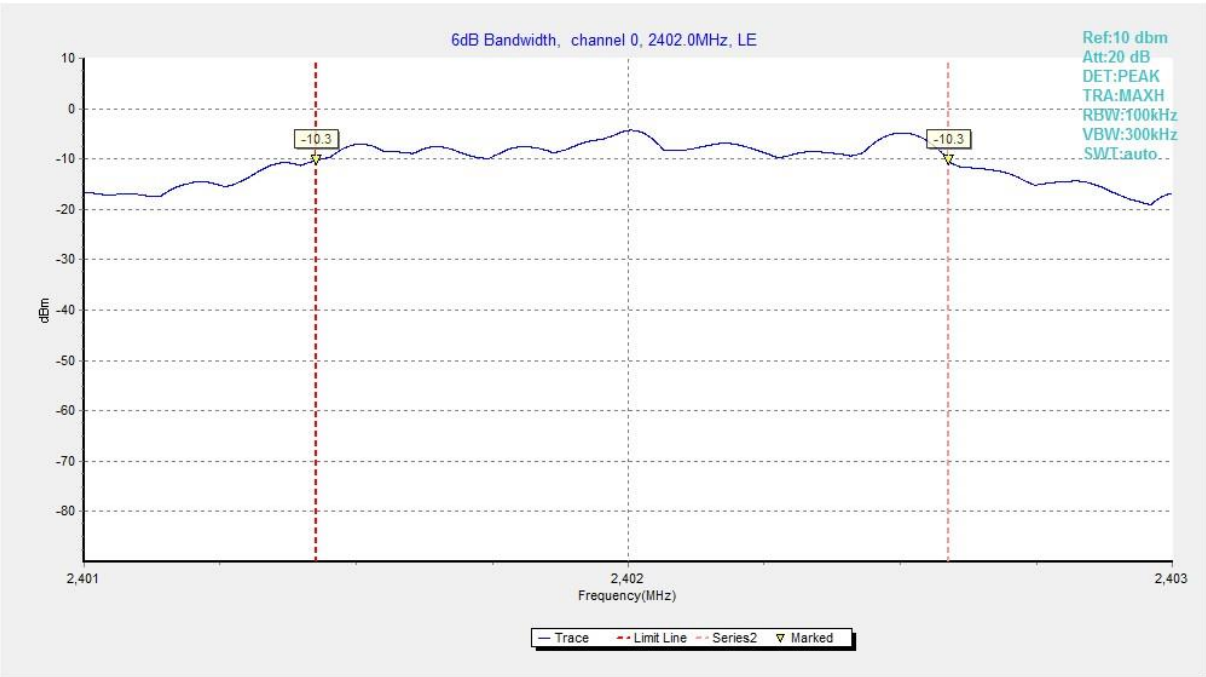

Fig.10 6dB Bandwidth (Ch 0), LE 2M

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Fig.11 6dB Bandwidth (Ch 19), LE 2M

Fig.12 6dB Bandwidth (Ch 39), LE 2M

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A.4 Band Edges Compliance

Measurement Limit:

Standard	Limit (dB)
FCC 47 CFR Part 15.247 (d)	> 20

Measurement Result:

Mode	Frequency (MHz)	Test Results (dBc)		Conclusion
LE 1M	2402(CH0)	Fig.13	59.86	**P**
	2480(CH39)	Fig.14	62.49	**P**
LE 2M	2402(CH0)	Fig.15	31.12	**P**
	2480(CH39)	Fig.16	57.19	**P**

See below for test graphs.

Conclusion: PASS

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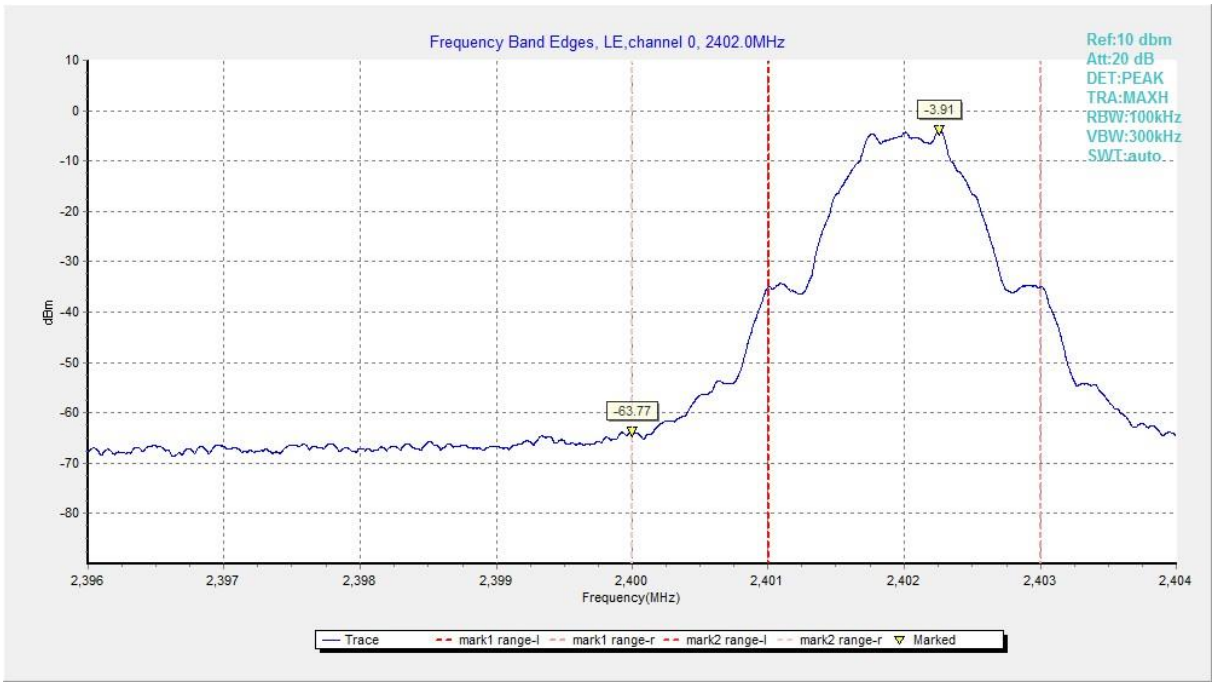

Fig.13 Band Edges (Ch 0), LE 1M

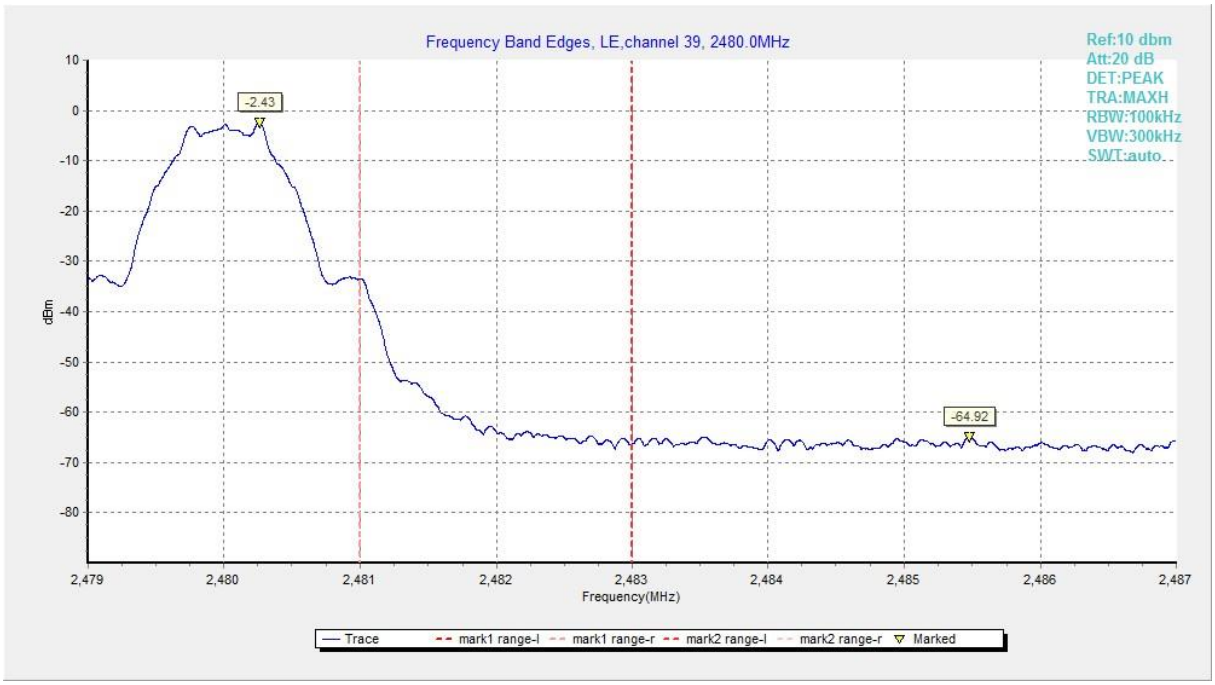

Fig.14 Band Edges (Ch 39), LE 1M

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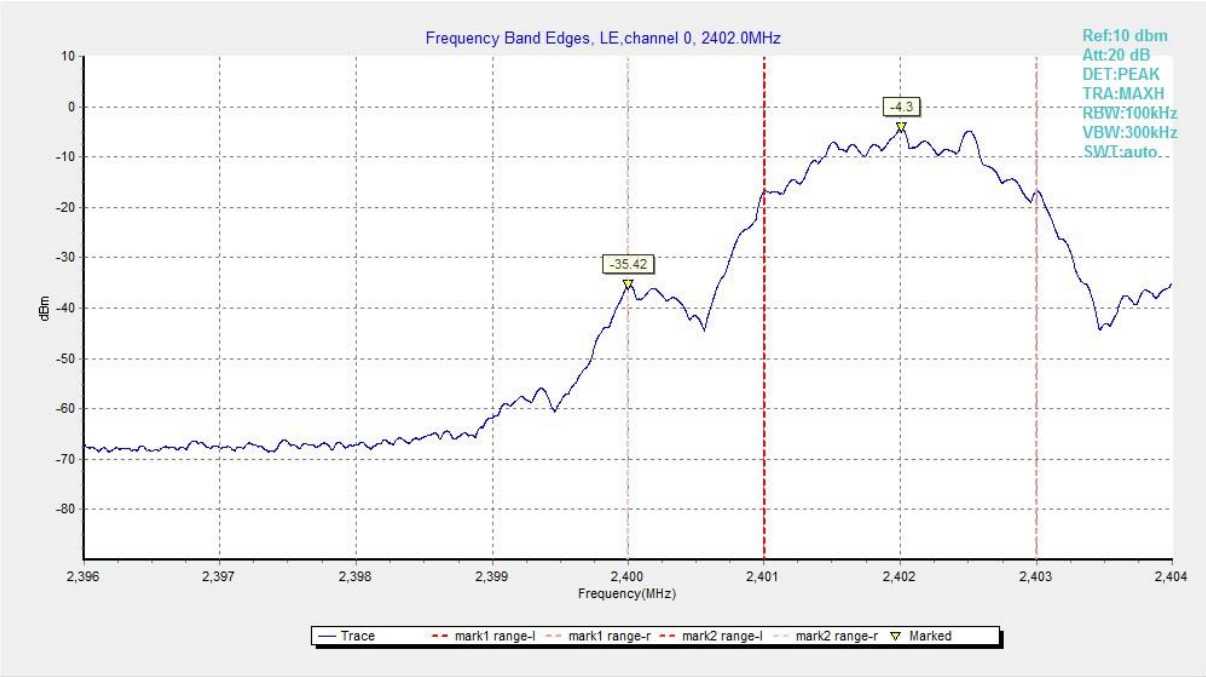

Fig.15 Band Edges (Ch 0), LE 2M

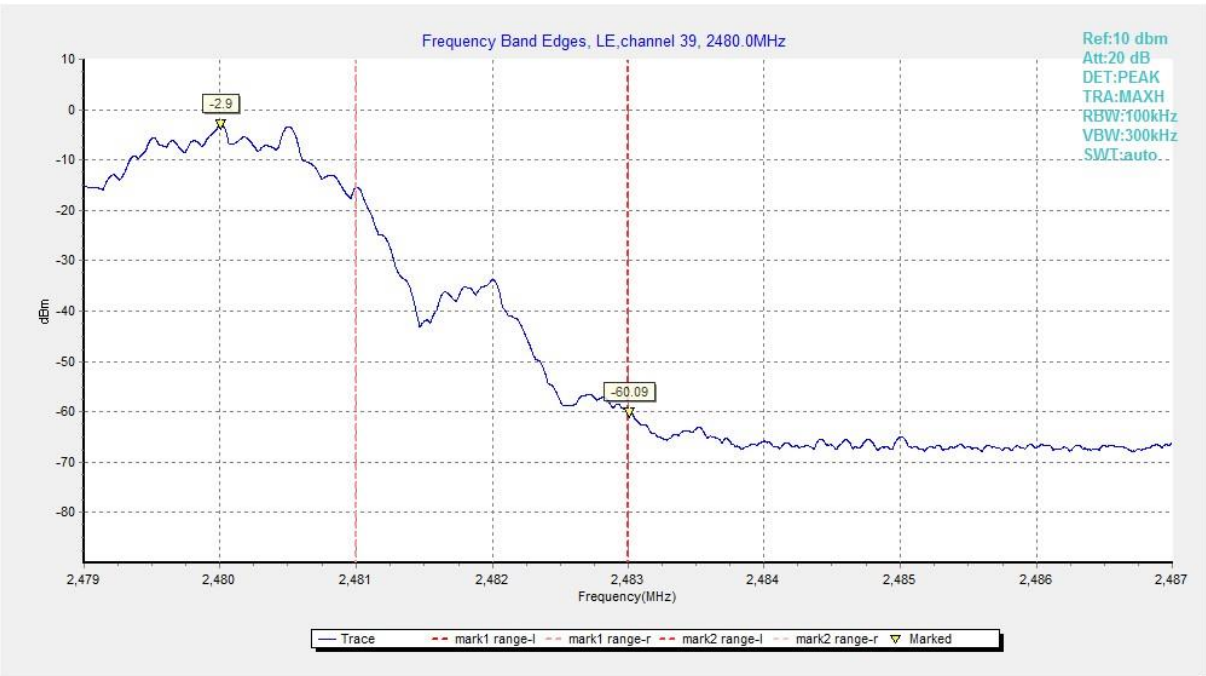

Fig.16 Band Edges (Ch 39), LE 2M

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A.5 Transmitter Spurious Emission - Conducted

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

Measurement Results:

MODE	Channel	Frequency Range	Test Results	Conclusion
LE 1M	0	2.402 GHz	Fig.17	**P**
		1GHz -3GHz	Fig.18	**P**
		3GHz-10GHz	Fig.19	**P**
	19	2.440 GHz	Fig.20	**P**
		1GHz -3GHz	Fig.21	**P**
		3GHz-10GHz	Fig.22	**P**
	39	2.480 GHz	Fig.23	**P**
		1GHz -3GHz	Fig.24	**P**
		3GHz-10GHz	Fig.25	**P**
	All channels	30MHz-1GHz	Fig.26	**P**
		10GHz-26GHz	Fig.27	**P**
LE 2M	0	2.402 GHz	Fig.28	**P**
		1GHz -3GHz	Fig.29	**P**
		3GHz-10GHz	Fig.30	**P**
	19	2.440 GHz	Fig.31	**P**
		1GHz -3GHz	Fig.32	**P**
		3GHz-10GHz	Fig.33	**P**
	39	2.480 GHz	Fig.34	**P**
		1GHz -3GHz	Fig.35	**P**
		3GHz-10GHz	Fig.36	**P**
	All channels	30MHz-1GHz	Fig.37	**P**
		10GHz-26GHz	Fig.38	**P**

See below for test graphs.

Conclusion: Pass

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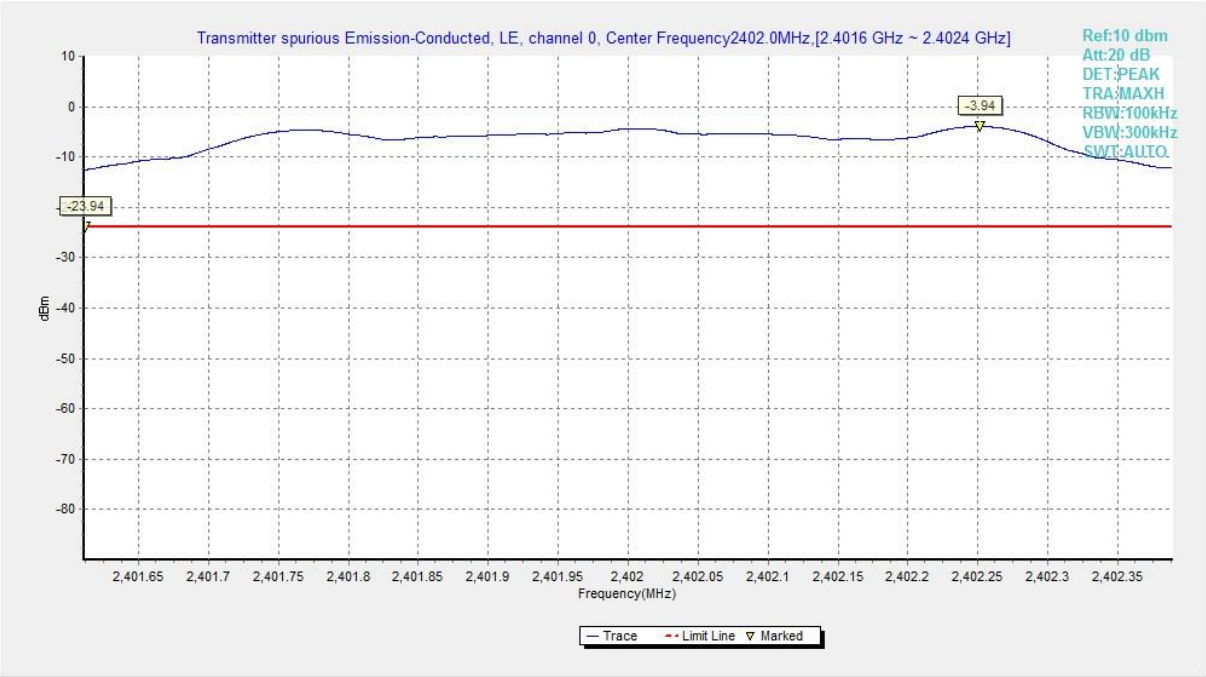

Fig.17 Conducted Spurious Emission (Ch0, Center Frequency), LE 1M

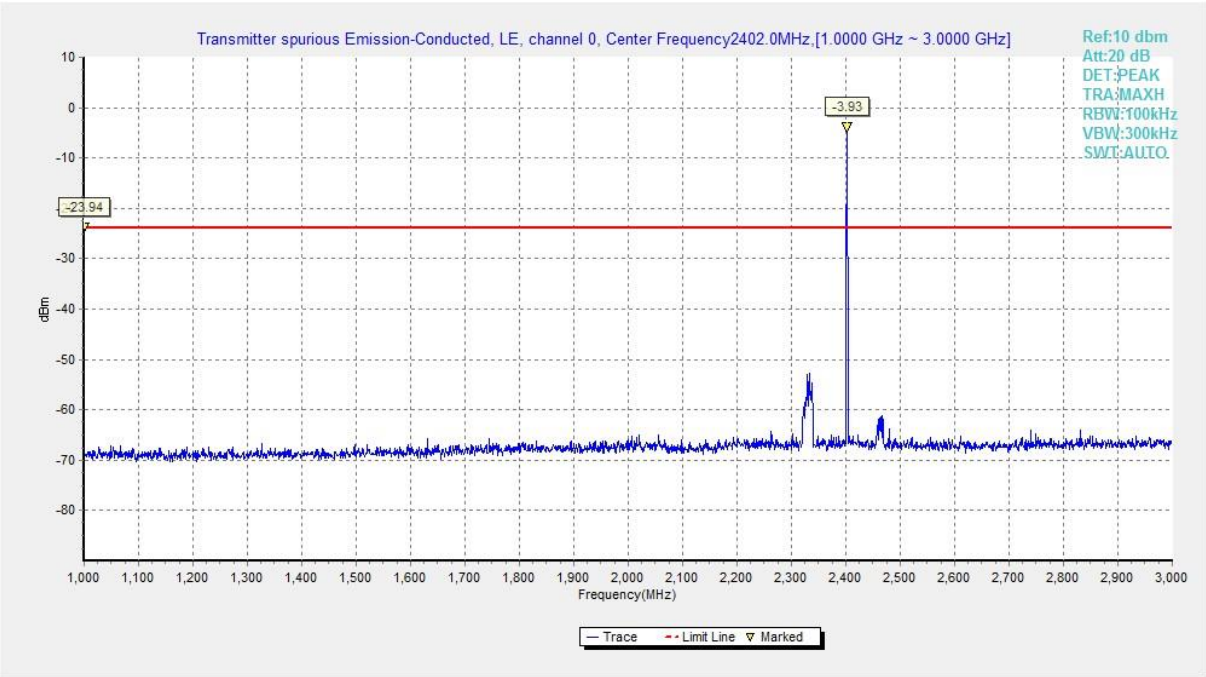

Fig.18 Conducted Spurious Emission (Ch0, 1 GHz-3 GHz), LE 1M

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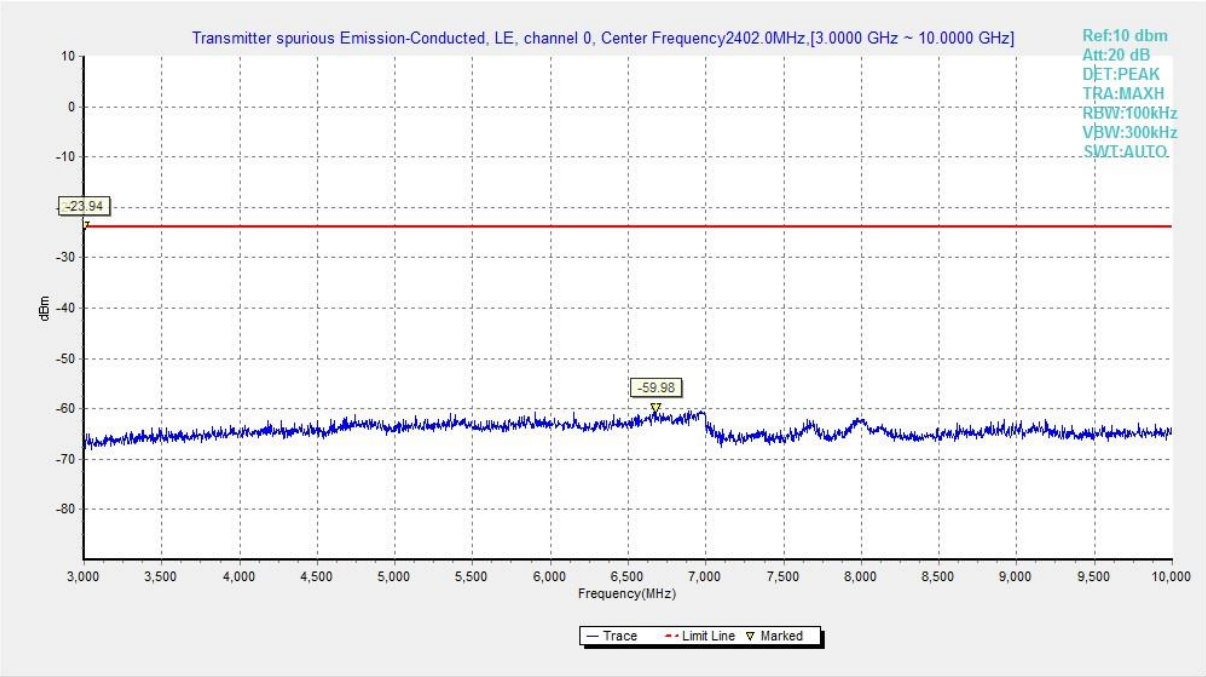

Fig.19 Conducted Spurious Emission (Ch0, 3 GHz-10 GHz), LE 1M

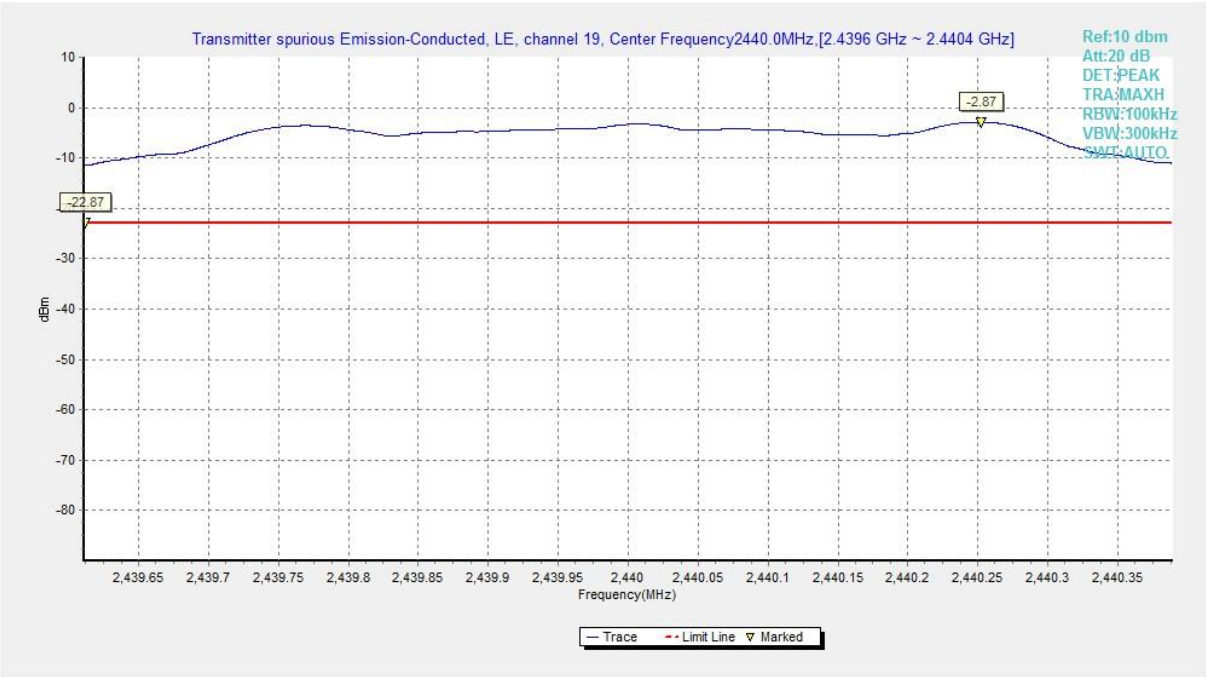

Fig.20 Conducted Spurious Emission (Ch19, Center Frequency), LE 1M

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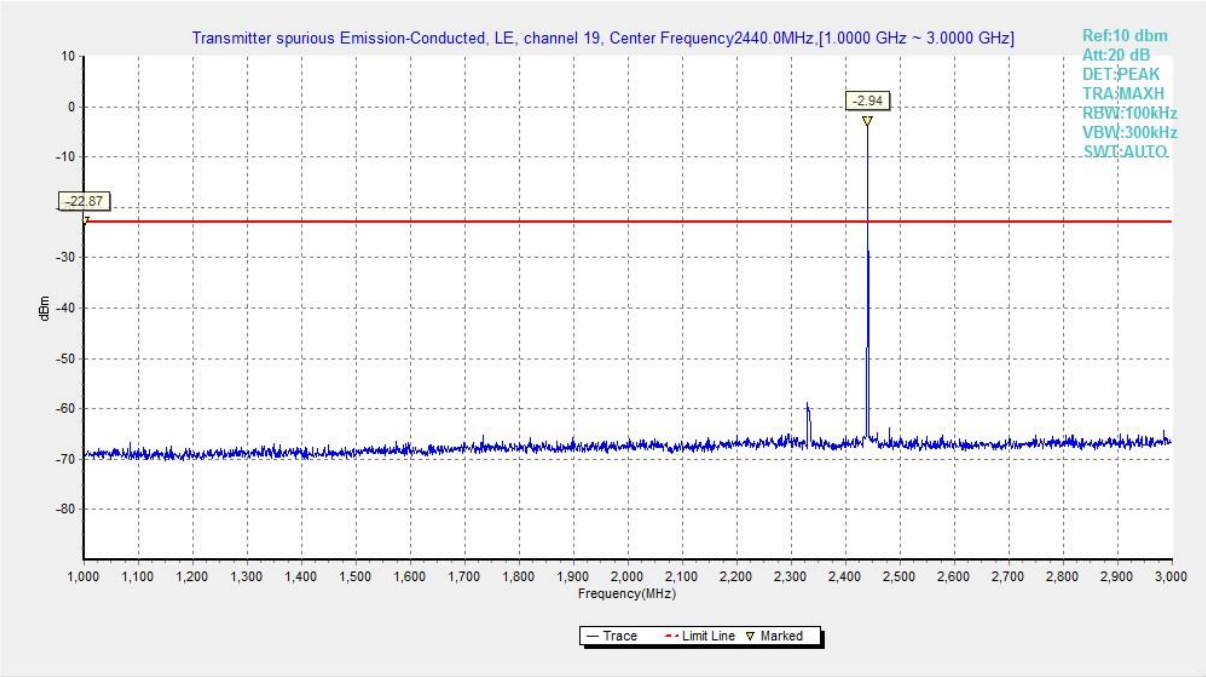

Fig.21 Conducted Spurious Emission (Ch19, 1 GHz-3 GHz), LE 1M

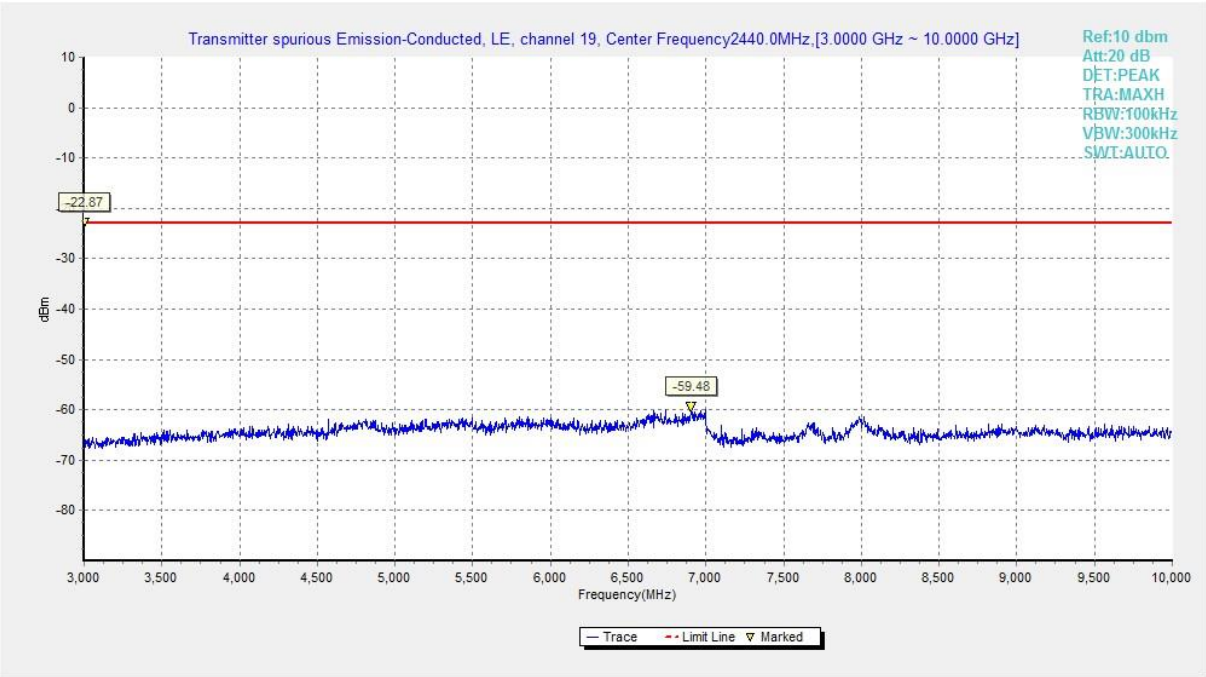

Fig.22 Conducted Spurious Emission (Ch19, 3 GHz-10 GHz), LE 1M

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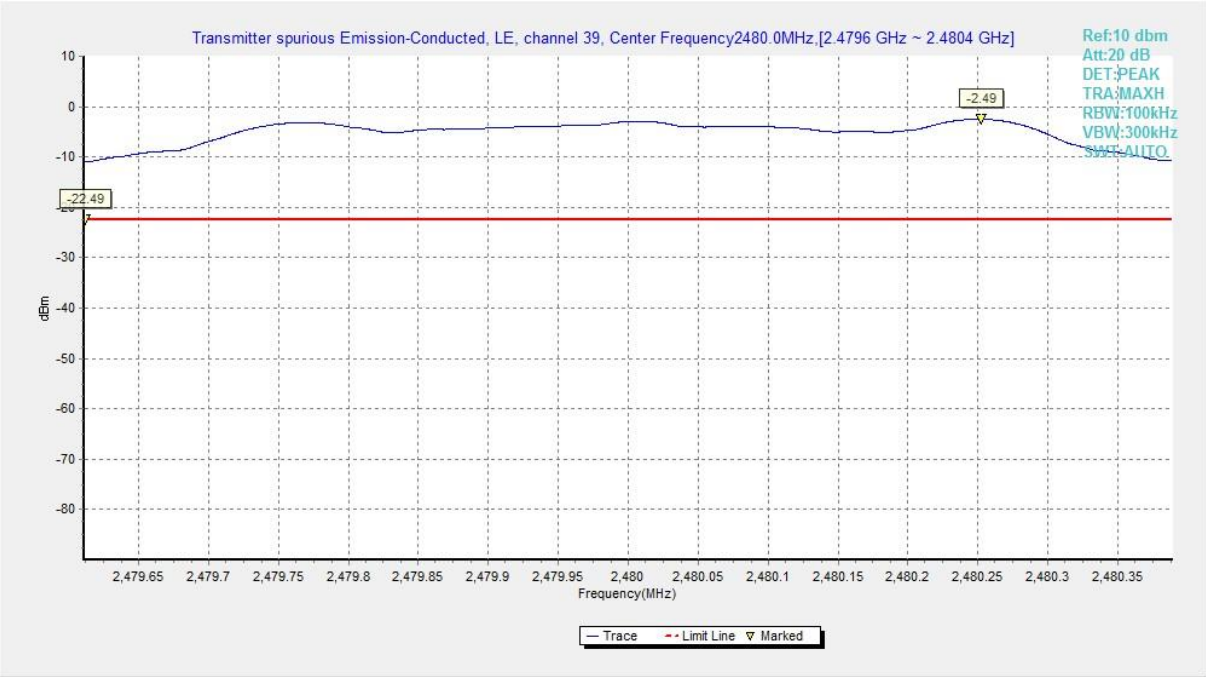

Fig.23 Conducted Spurious Emission (Ch39, Center Frequency), LE 1M

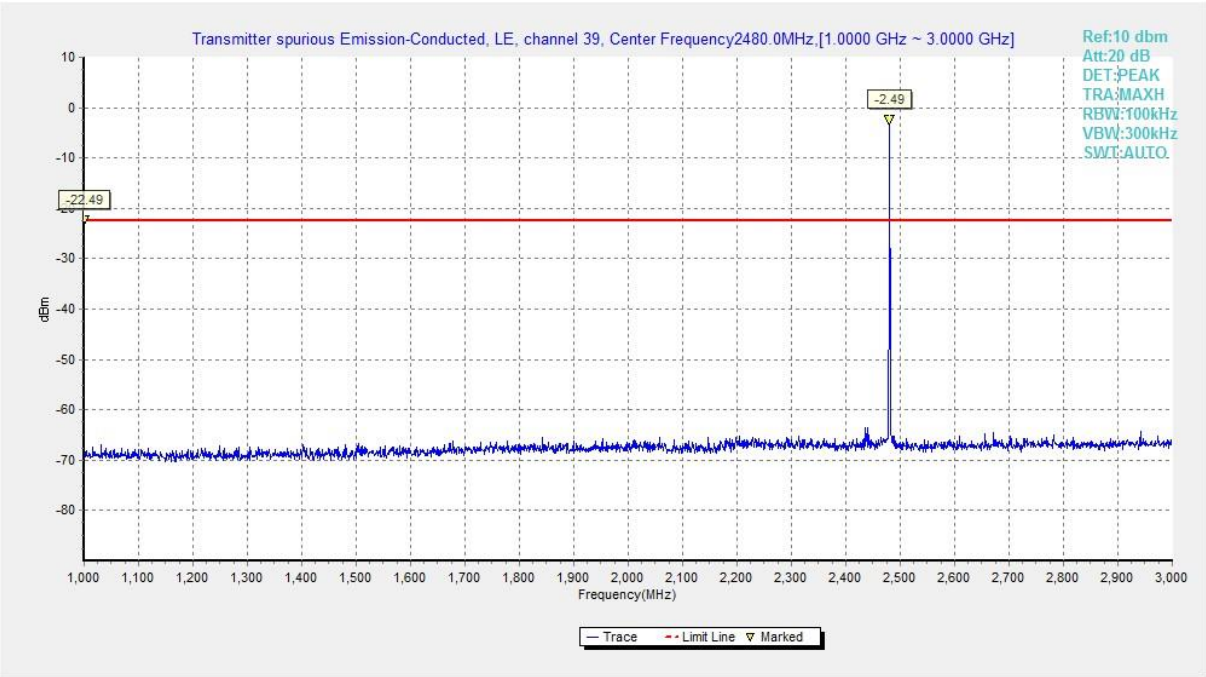

Fig.24 Conducted Spurious Emission (Ch39, 1 GHz-3 GHz), LE 1M

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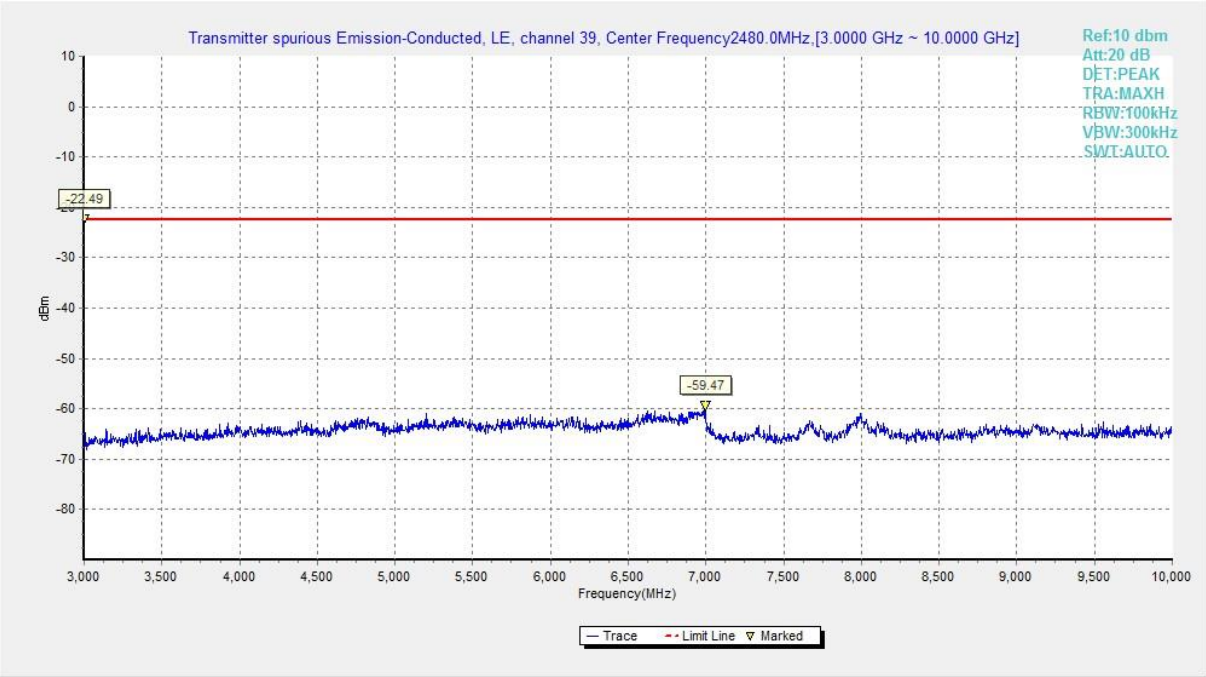

Fig.25 Conducted Spurious Emission (Ch39, 3 GHz-10 GHz), LE 1M

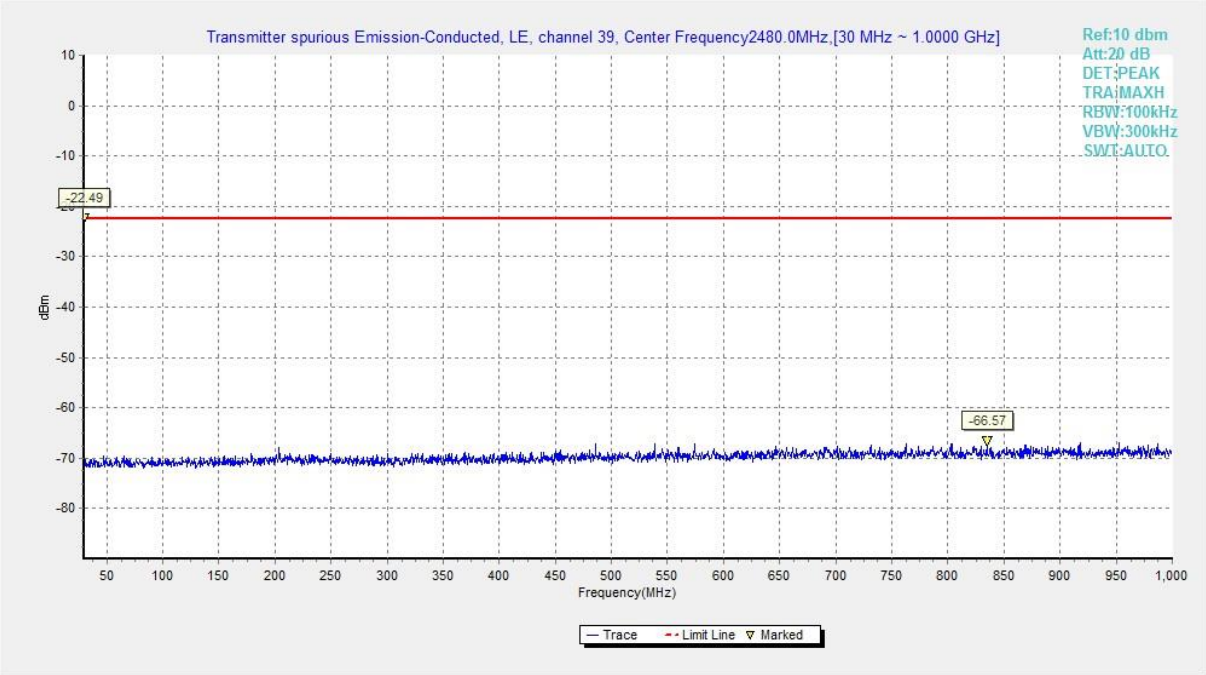

Fig.26 Conducted Spurious Emission (All channels, 30 MHz-1 GHz), LE 1M

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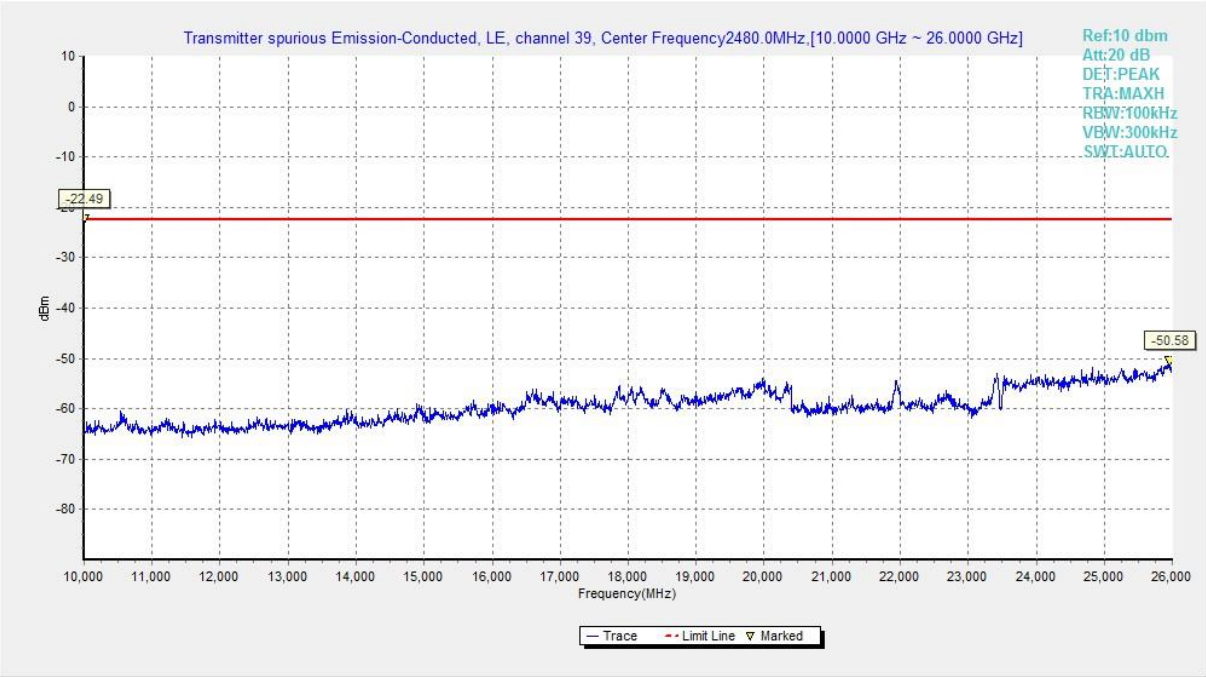

Fig.27 Conducted Spurious Emission (All channels, 10 GHz-26 GHz), LE 1M

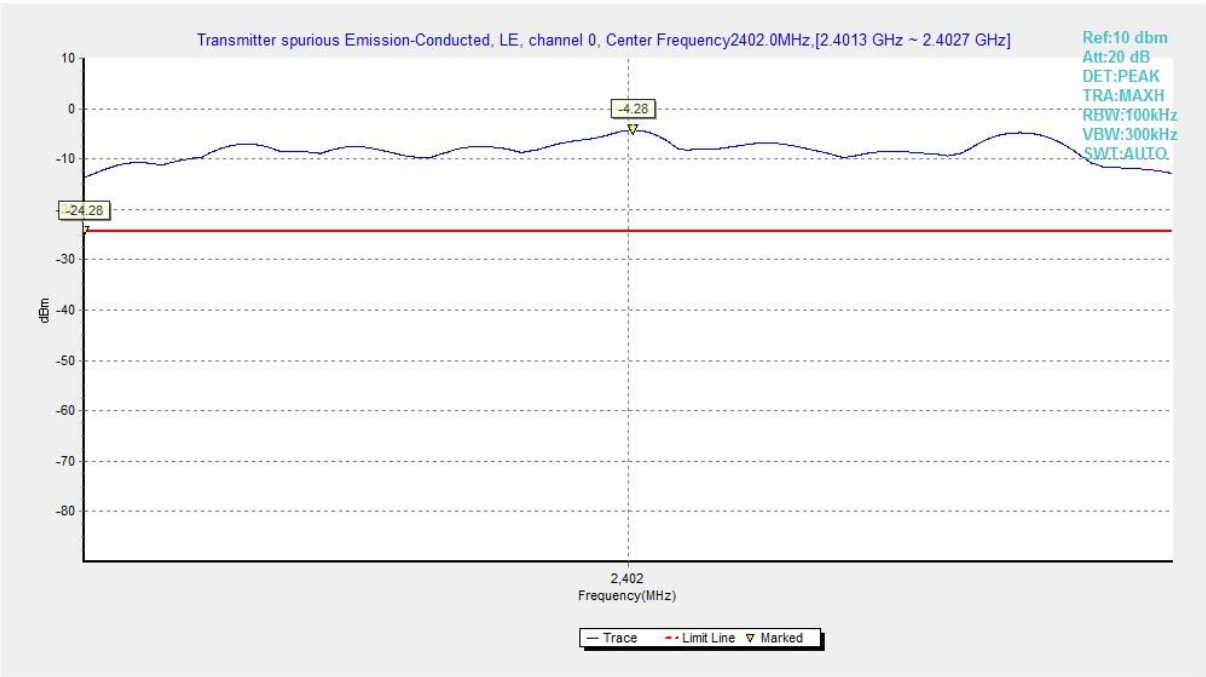

Fig.28 Conducted Spurious Emission (Ch0, Center Frequency), LE 2M

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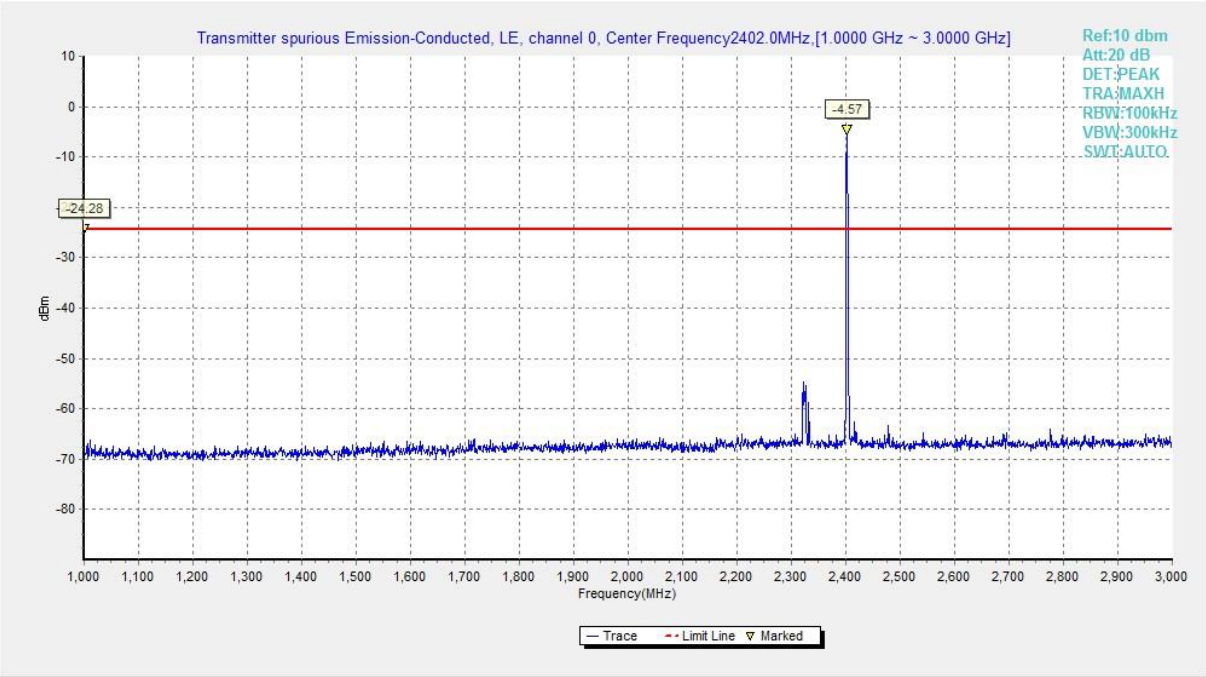

Fig.29 Conducted Spurious Emission (Ch0, 1 GHz-3 GHz), LE 2M

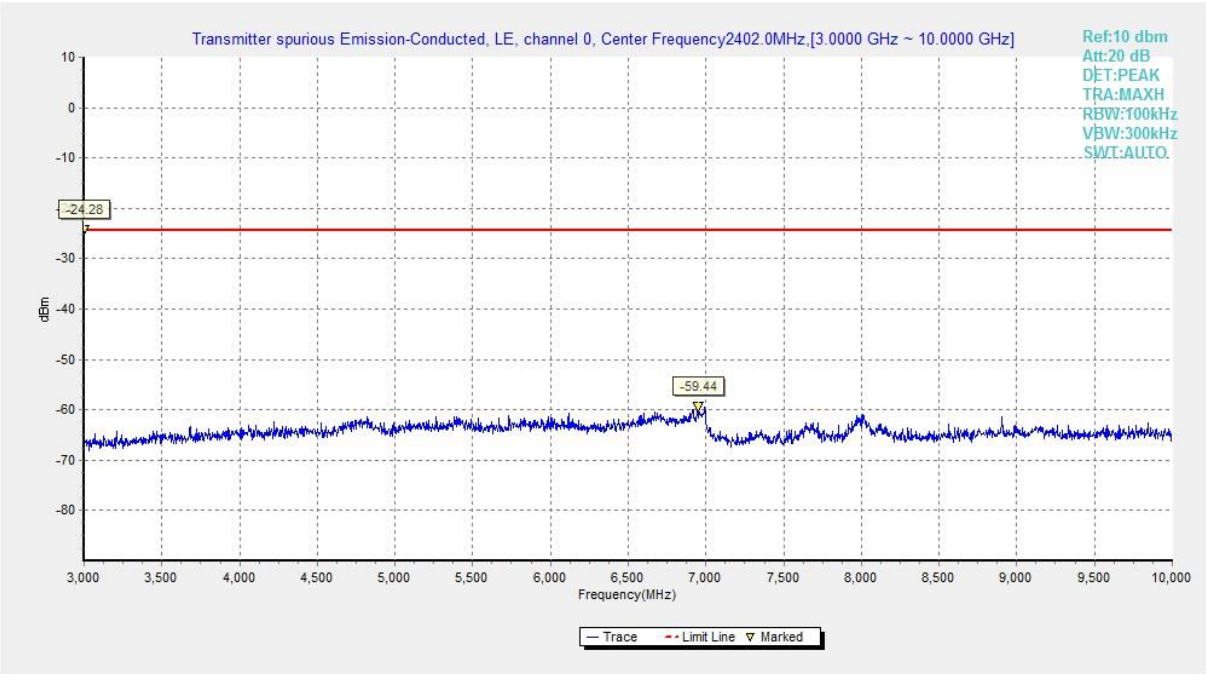

Fig.30 Conducted Spurious Emission (Ch0, 3 GHz-10 GHz), LE 2M

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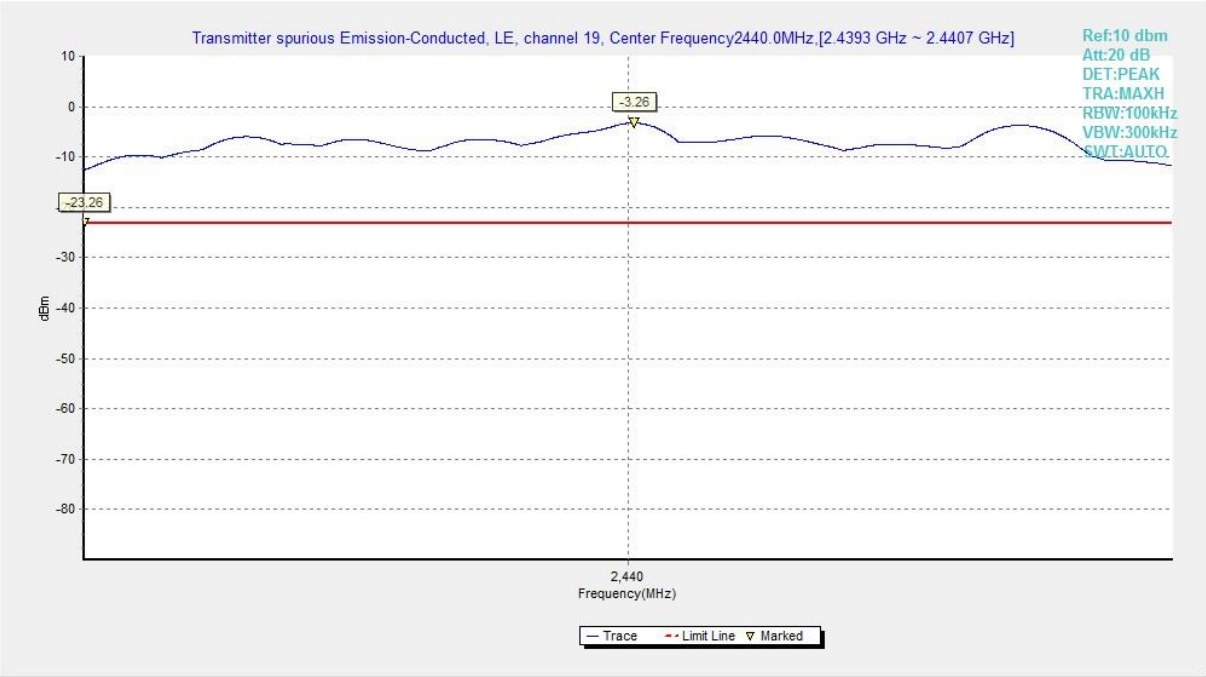

Fig.31 Conducted Spurious Emission (Ch19, Center Frequency), LE 2M

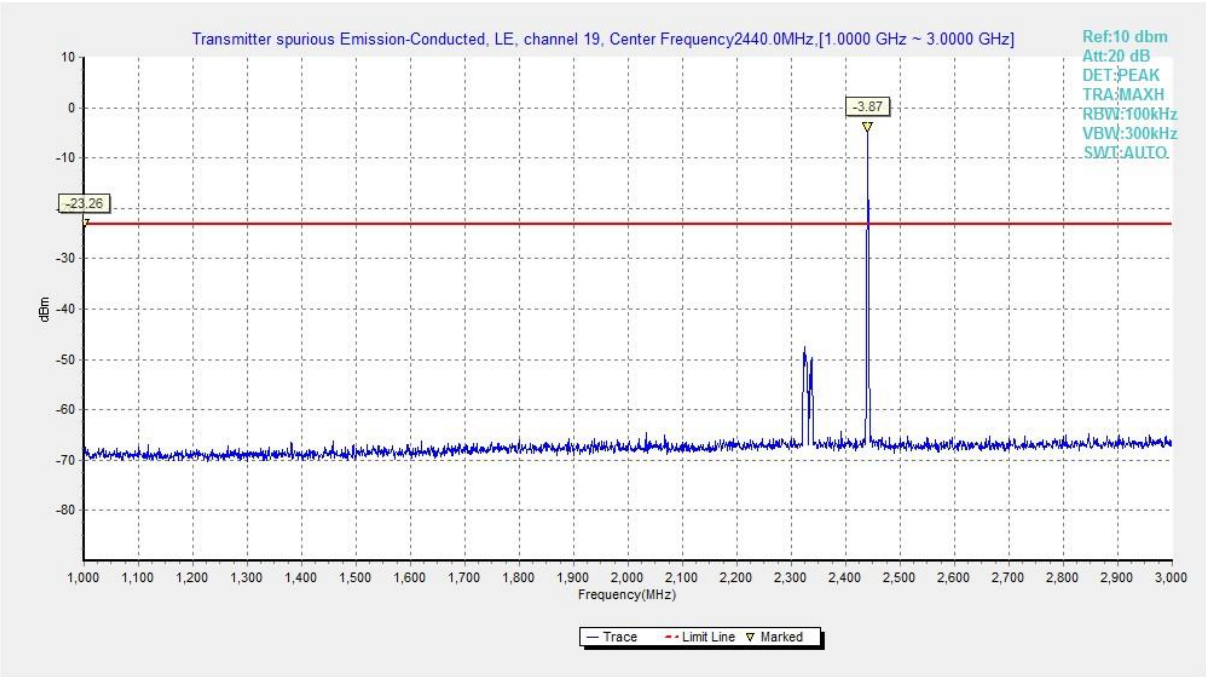

Fig.32 Conducted Spurious Emission (Ch19, 1 GHz-3 GHz), LE 2M

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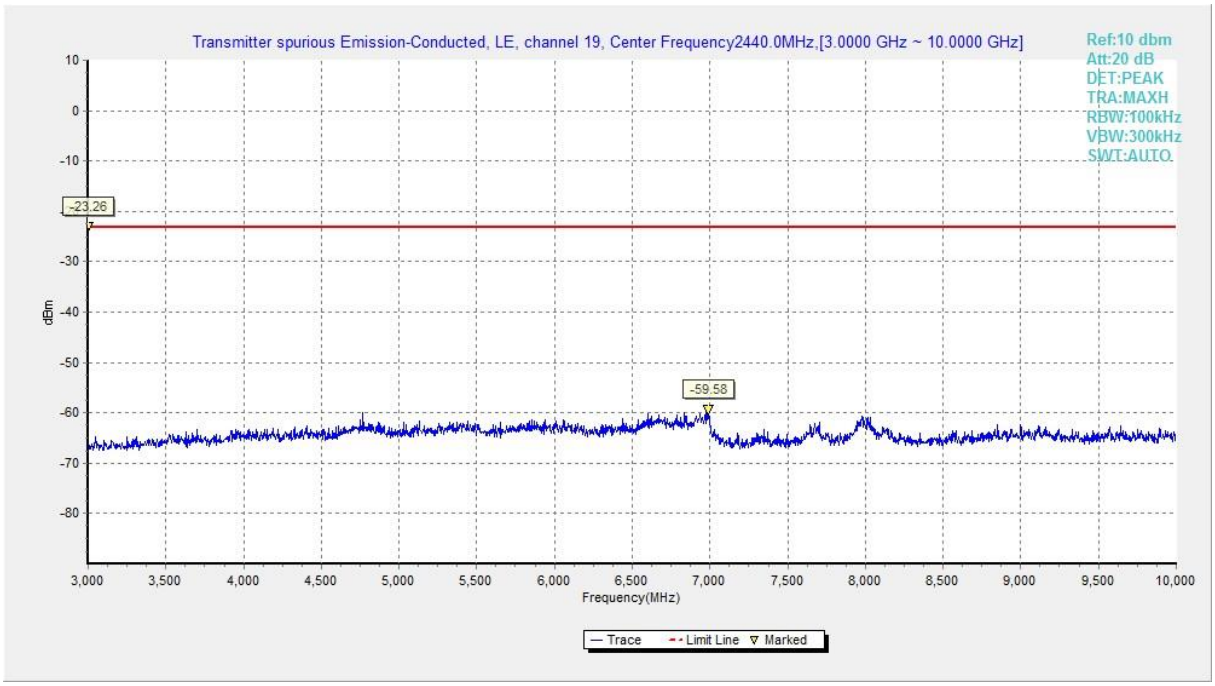

Fig.33 Conducted Spurious Emission (Ch19, 3 GHz-10 GHz), LE 2M

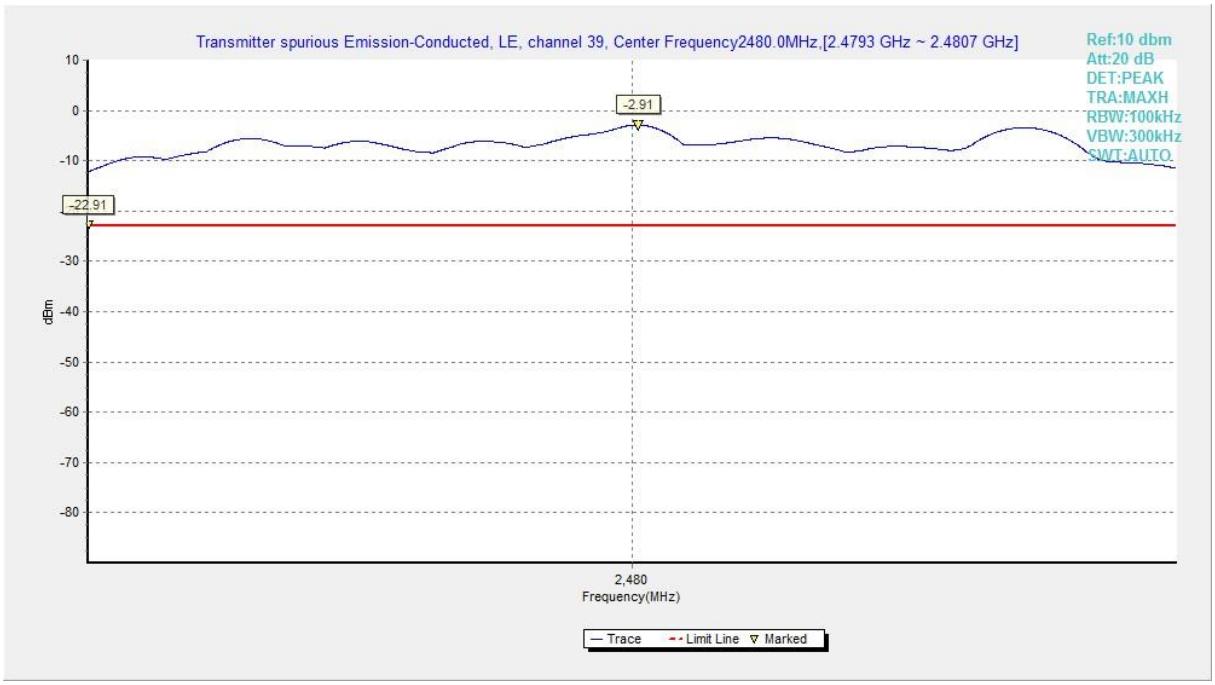

Fig.34 Conducted Spurious Emission (Ch39, Center Frequency), LE 2M

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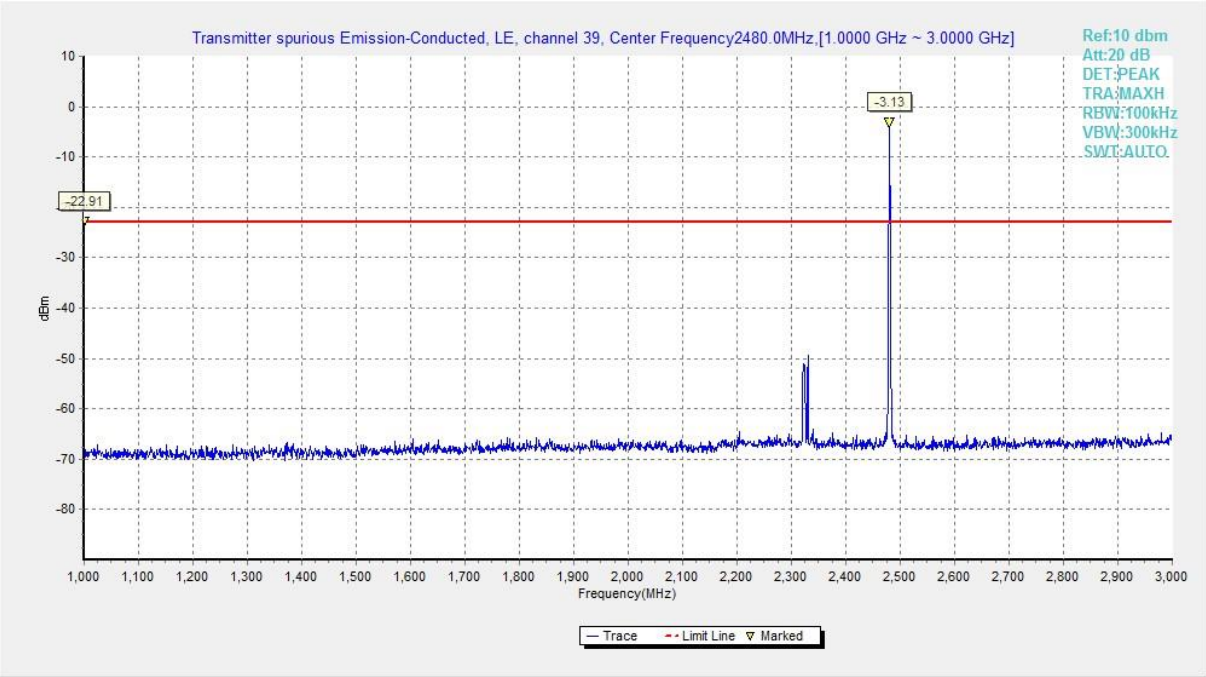

Fig.35 Conducted Spurious Emission (Ch39, 1 GHz-3 GHz), LE 2M

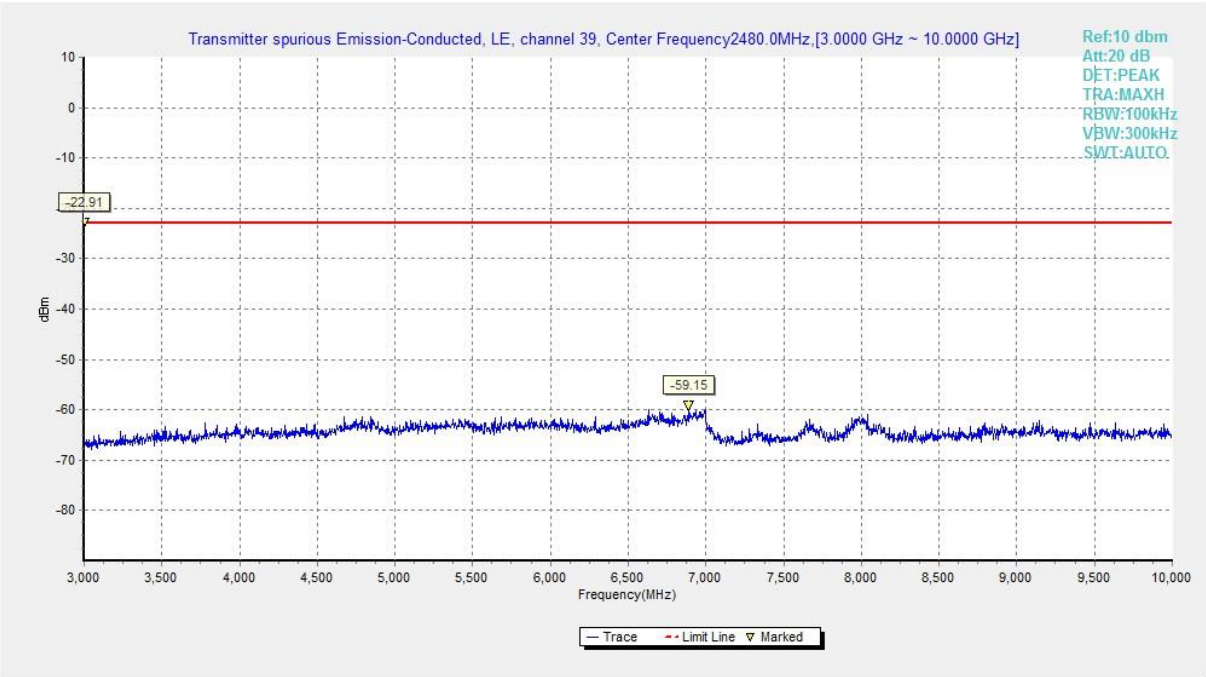

Fig.36 Conducted Spurious Emission (Ch39, 3 GHz-10 GHz), LE 2M

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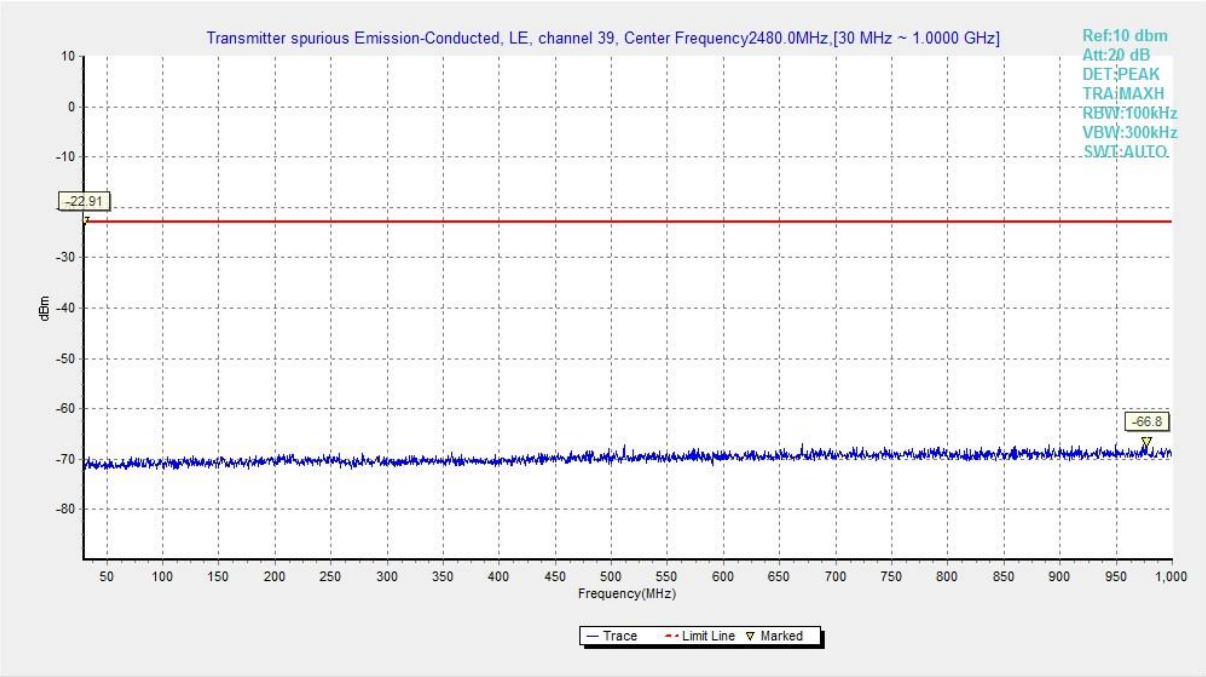

Fig.37 Conducted Spurious Emission (All channels, 30 MHz-1 GHz), LE 2M

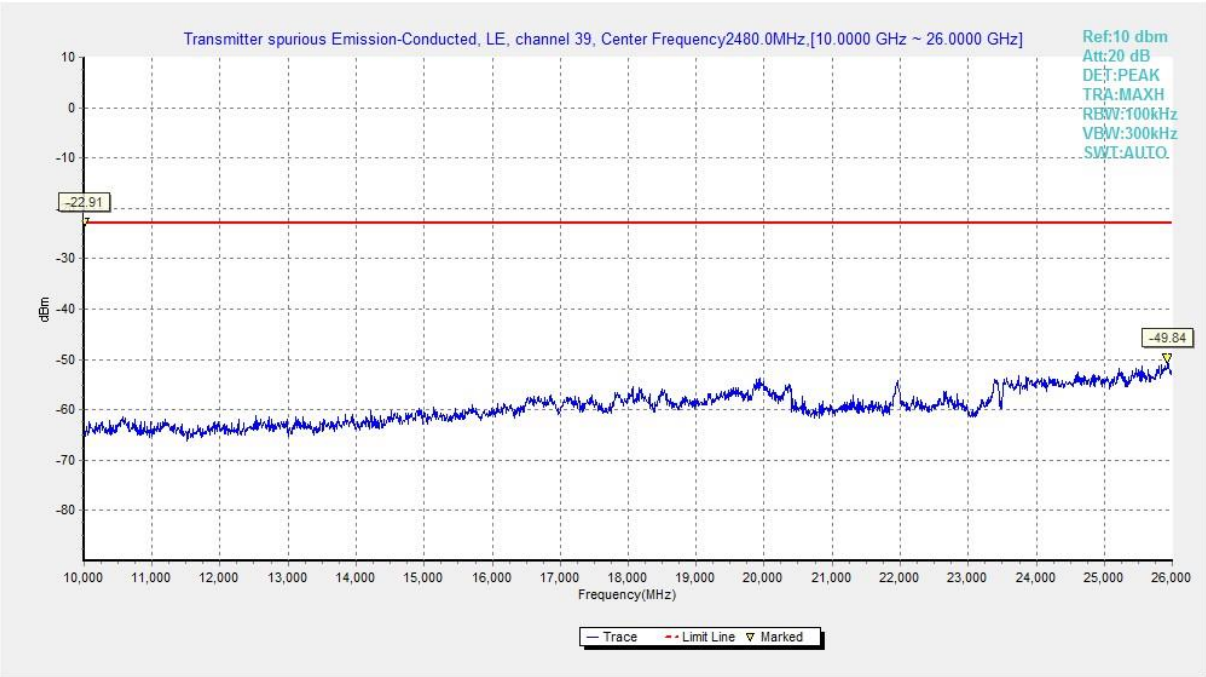

Fig.38 Conducted Spurious Emission (All channels, 10 GHz-26 GHz), LE 2M

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A.6 Transmitter Spurious Emission - Radiated

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

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

Limit in restricted band:

Frequency of emission (MHz)	Field strength(μV/m)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Condition:

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	120kHz/300kHz	5
1000-4000	1MHz/3MHz	15
4000-18000	1MHz/3MHz	40
18000-26500	1MHz/3MHz	20

Note: According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band from 9kHz to 30MHz.Therefore, the measurement starts from 30MHz to tenth harmonic. The measurement results include the horizontal polarization and vertical polarization measurements.

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Measurement Results:

Mode	Channel	Frequency Range	Test Results	Conclusion
LE 1M	0	1 GHz ~3 GHz	Fig.39	**P**
		3 GHz ~18 GHz	Fig.40	**P**
	19	1 GHz ~3 GHz	Fig.41	**P**
		3 GHz ~18 GHz	Fig.42	**P**
	39	1 GHz ~3 GHz	Fig.43	**P**
		3 GHz ~18 GHz	Fig.44	**P**
	Restricted Band(CH0)	2.38 GHz ~ 2.45 GHz	Fig.45	**P**
	Restricted Band(CH39)	2.45 GHz ~ 2.5 GHz	Fig.46	**P**
	All channels	9 kHz ~30 MHz	Fig.47	**P**
		30 MHz ~1 GHz	Fig.48	**P**
		18 GHz ~ 26.5 GHz	Fig.49	**P**
LE 2M	0	1 GHz ~3 GHz	Fig.50	**P**
		3 GHz ~18 GHz	Fig.51	**P**
	19	1 GHz ~3 GHz	Fig.52	**P**
		3 GHz ~18 GHz	Fig.53	**P**
	39	1 GHz ~3 GHz	Fig.54	**P**
		3 GHz ~18 GHz	Fig.55	**P**
	Restricted Band(CH0)	2.38 GHz ~ 2.45 GHz	Fig.56	**P**
	Restricted Band(CH39)	2.45 GHz ~ 2.5 GHz	Fig.57	**P**
	All channels	9 kHz ~30 MHz	Fig.58	**P**
		30 MHz ~1 GHz	Fig.59	**P**
		18 GHz ~ 26.5 GHz	Fig.60	**P**

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Worst Case Result

For LE 1M:

GFSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9683.000000	45.39	74.00	28.61	H	4.7
10836.500000	46.87	74.00	27.13	V	6.0
12562.500000	48.38	74.00	25.62	H	8.4
15423.500000	49.62	74.00	24.38	V	12.5
16344.500000	52.19	74.00	21.81	V	15.0
17944.500000	52.15	74.00	21.85	V	17.3

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9883.500000	33.85	54.00	20.15	V	5.4
10973.500000	34.63	54.00	19.37	V	6.6
13188.000000	36.48	54.00	17.52	H	9.8
15502.000000	37.41	54.00	16.59	V	12.6
16777.500000	39.93	54.00	14.07	H	15.8
17908.000000	40.62	54.00	13.38	H	17.4

GFSK CH19 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
8305.000000	44.43	74.00	29.57	V	3.5
9712.500000	45.49	74.00	28.51	V	4.7
10823.500000	46.46	74.00	27.54	V	6.4
12070.500000	48.21	74.00	25.79	V	8.2
15407.000000	49.82	74.00	24.18	V	12.5
16755.000000	53.02	74.00	20.98	V	15.6

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
6428.000000	32.27	54.00	21.73	V	2.6
9851.000000	33.76	54.00	20.24	H	5.4
11437.500000	34.59	54.00	19.41	V	6.7
13188.000000	36.29	54.00	17.71	V	9.8
14873.500000	37.30	54.00	16.70	V	11.7
17909.500000	40.86	54.00	13.14	H	17.4

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GFSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
6958.000000	45.10	74.00	28.90	V	2.5
9633.500000	45.47	74.00	28.53	V	4.4
11182.000000	46.21	74.00	27.79	H	6.1
13112.000000	48.12	74.00	25.88	H	9.2
15417.500000	49.38	74.00	24.62	V	12.4
16729.000000	52.24	74.00	21.76	V	15.4

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
6428.500000	32.37	54.00	21.63	H	2.6
9882.500000	33.76	54.00	20.24	V	5.4
10973.500000	34.61	54.00	19.39	H	6.6
13215.500000	36.20	54.00	17.80	V	9.9
15503.000000	37.33	54.00	16.67	H	12.7
17948.000000	40.87	54.00	13.13	V	17.2

For LE 2M:

GFSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9835.000000	45.15	74.00	28.85	H	5.0
11605.500000	48.44	74.00	25.56	H	7.3
12951.000000	47.99	74.00	26.01	V	9.2
14468.000000	49.00	74.00	25.00	V	11.7
16808.000000	52.17	74.00	21.83	H	15.8
17976.000000	52.21	74.00	21.79	V	16.9

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9880.500000	33.85	54.00	20.15	H	5.4
10884.500000	35.03	54.00	18.97	V	6.4
13217.000000	36.37	54.00	17.63	H	9.9
14463.000000	37.35	54.00	16.65	H	11.8
16810.000000	40.31	54.00	13.69	H	15.9
17942.000000	40.80	54.00	13.20	H	17.2

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GFSK CH19 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9816.000000	46.02	74.00	27.98	V	4.9
11457.500000	46.52	74.00	27.48	H	6.9
12048.000000	48.36	74.00	25.64	H	8.1
14517.500000	49.85	74.00	24.15	H	11.7
16882.500000	52.02	74.00	21.98	V	16.1
17938.500000	52.25	74.00	21.75	H	17.1

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9887.500000	33.79	54.00	20.21	H	5.3
11496.000000	34.81	54.00	19.19	H	6.8
13218.500000	36.22	54.00	17.78	V	9.9
14488.000000	37.51	54.00	16.49	V	11.7
16900.500000	39.84	54.00	14.16	V	15.9
17911.000000	40.76	54.00	13.24	H	17.3

GFSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9350.000000	46.17	74.00	27.83	V	3.8
11311.500000	46.30	74.00	27.70	H	6.3
11860.000000	48.06	74.00	25.94	V	7.8
14317.500000	49.00	74.00	25.00	V	11.6
16768.500000	51.33	74.00	22.67	H	15.6
17913.000000	52.37	74.00	21.63	H	17.3

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
9878.000000	33.83	54.00	20.17	H	5.3
11039.500000	34.52	54.00	19.48	H	6.4
13248.000000	36.15	54.00	17.85	V	9.7
14489.500000	37.40	54.00	16.60	V	11.7
16783.500000	39.94	54.00	14.06	H	15.9
17910.000000	40.79	54.00	13.21	H	17.4

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”, and Antenna Factor, the gain of the preamplifier, the cable loss. P_{Mea} is the field strength recorded from the instrument.

The measurement results are obtained as described below:

Result= P_{Mea} +Cable Loss +Antenna Factor-Gain of the preamplifier.

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See below for test graphs.

Conclusion: Pass

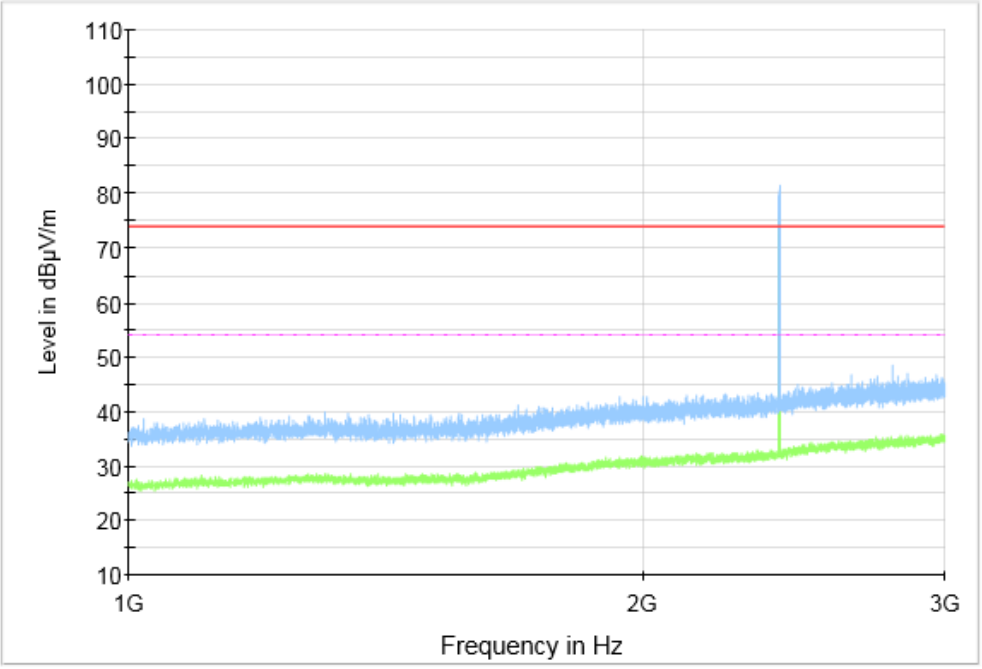

Fig.39 Radiated Spurious Emission (GFSK, Ch0, 1 GHz ~3 GHz), LE 1M

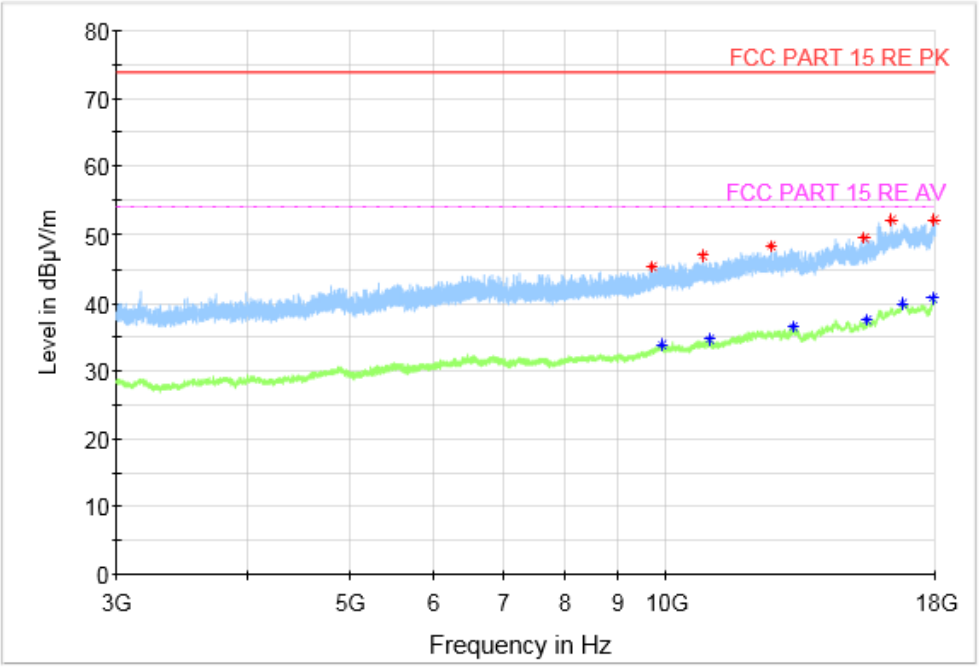

Fig.40 Radiated Spurious Emission (GFSK, Ch0, 3 GHz ~18 GHz), LE 1M

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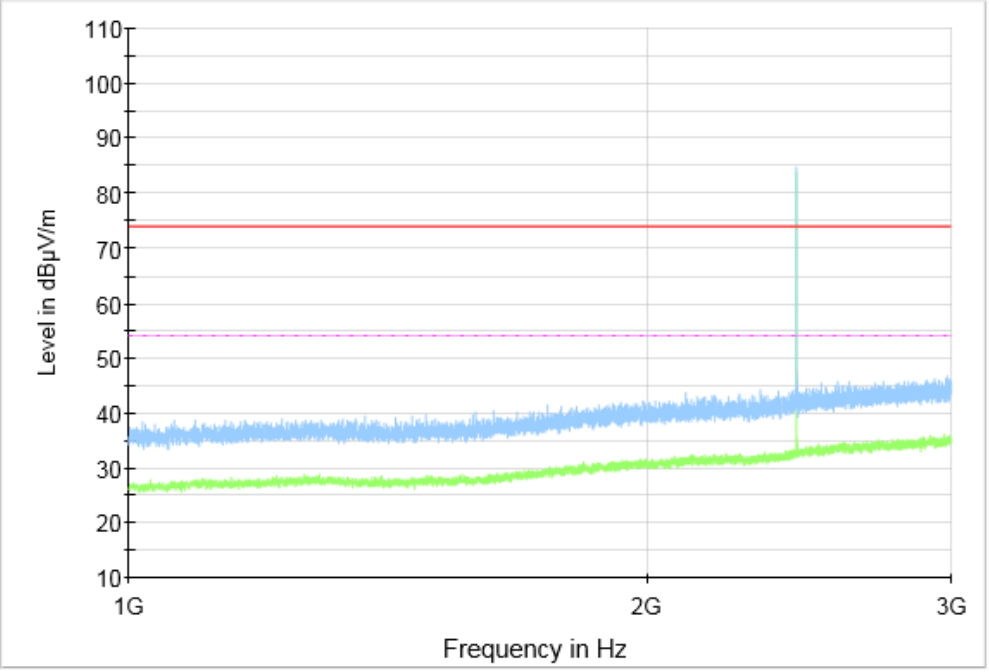

Fig.41 Radiated Spurious Emission (GFSK, Ch19, 1 GHz ~3 GHz), LE 1M

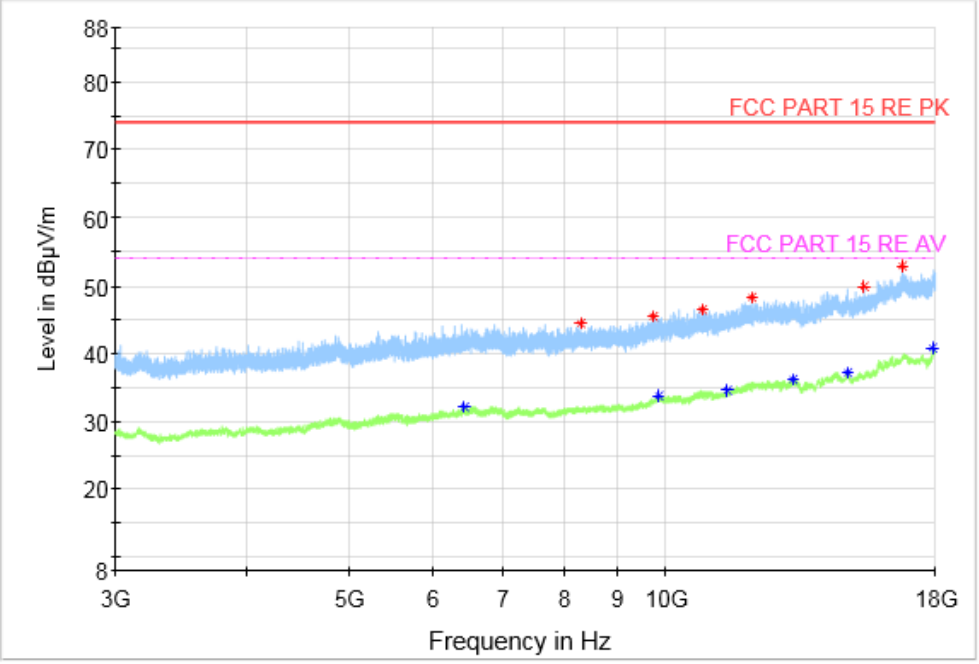

Fig.42 Radiated Spurious Emission (GFSK, Ch19, 3 GHz ~18 GHz), LE 1M

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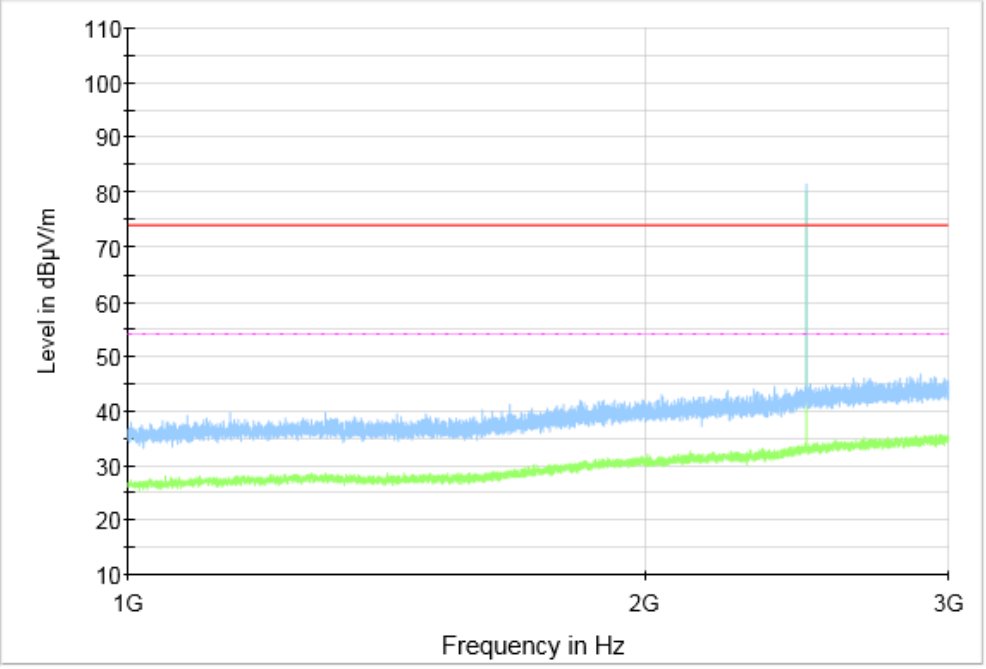

Fig.43 Radiated Spurious Emission (GFSK, Ch39, 1 GHz ~3 GHz), LE 1M

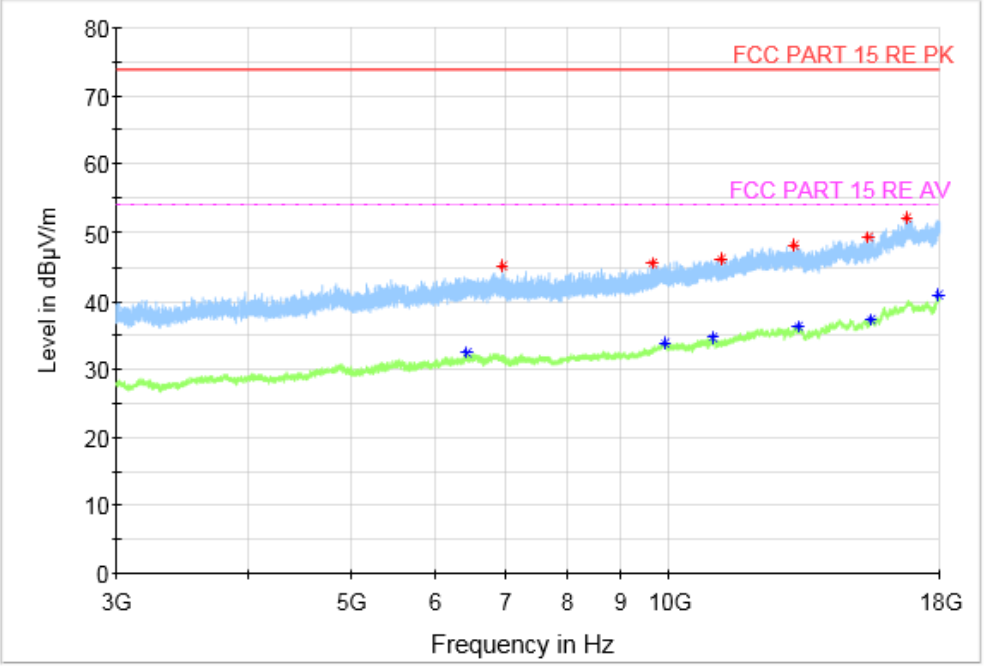

Fig.44 Radiated Spurious Emission (GFSK, Ch39, 3 GHz ~18 GHz), LE 1M

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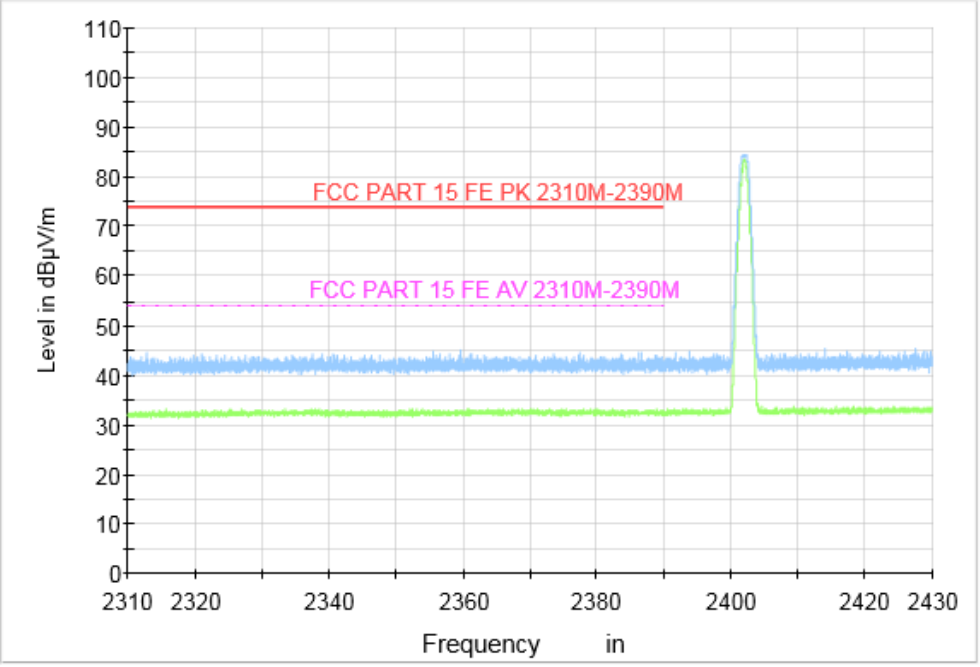

Fig.45 Radiated Band Edges (GFSK, Ch0, 2380GHz~2450GHz), LE 1M

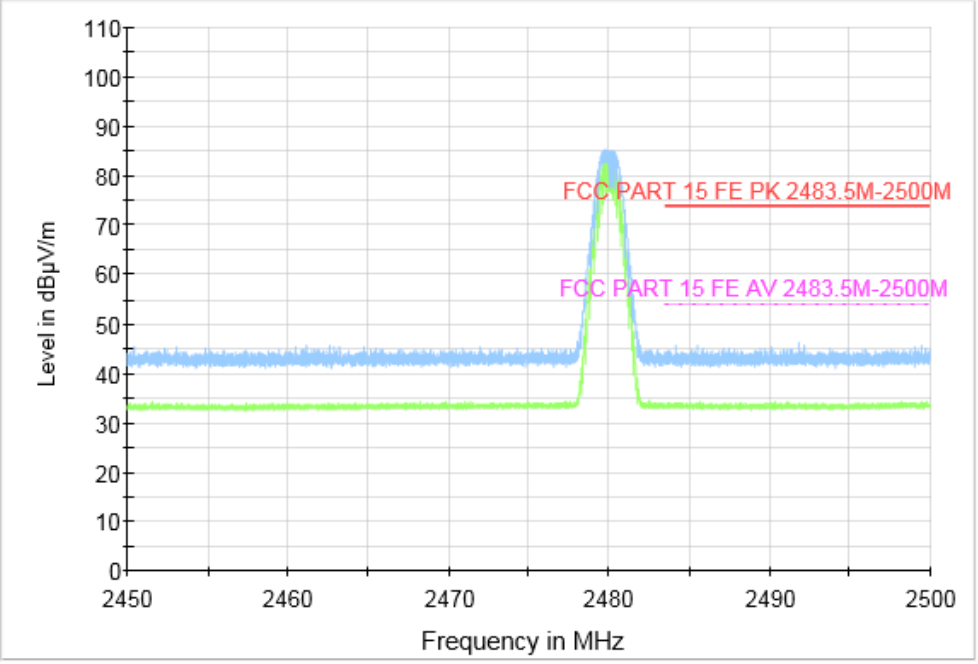

Fig.46 Radiated Band Edges (GFSK, Ch39, 2450GHz~2500GHz), LE 1M

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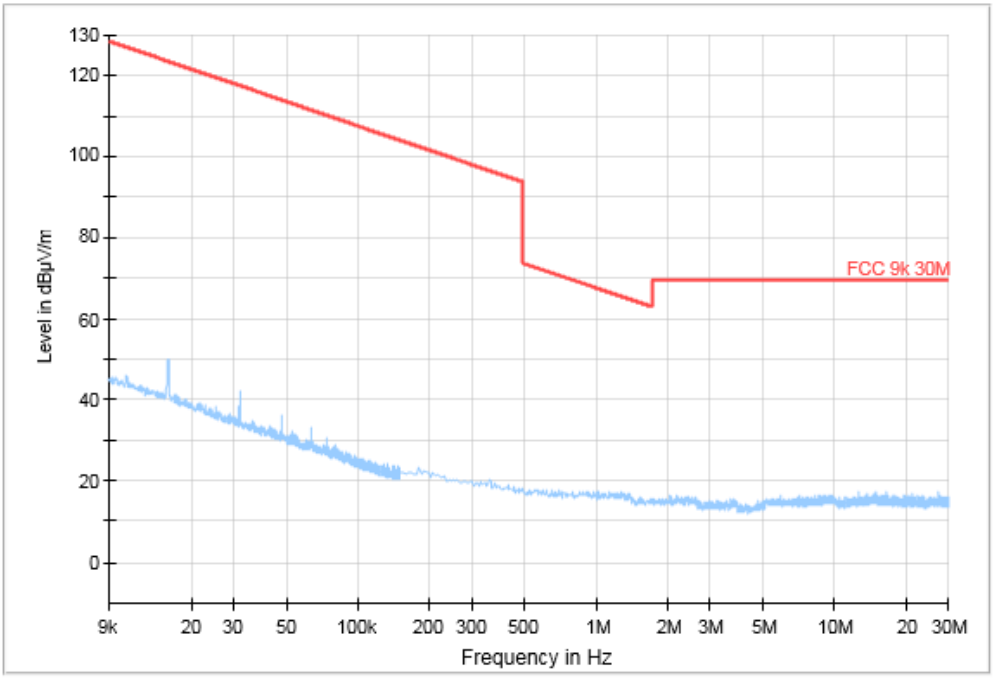

Fig.47 Radiated Spurious Emission (All Channels, 9 kHz-30 MHz), LE 1M

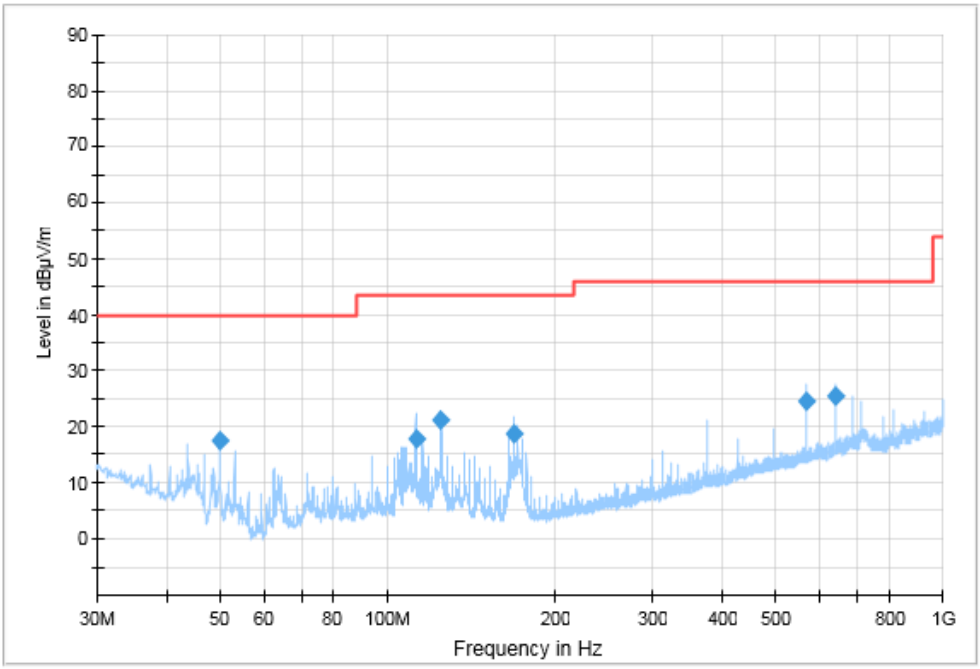

Fig.48 Radiated Spurious Emission (All Channels, 30 MHz-1 GHz), LE 1M

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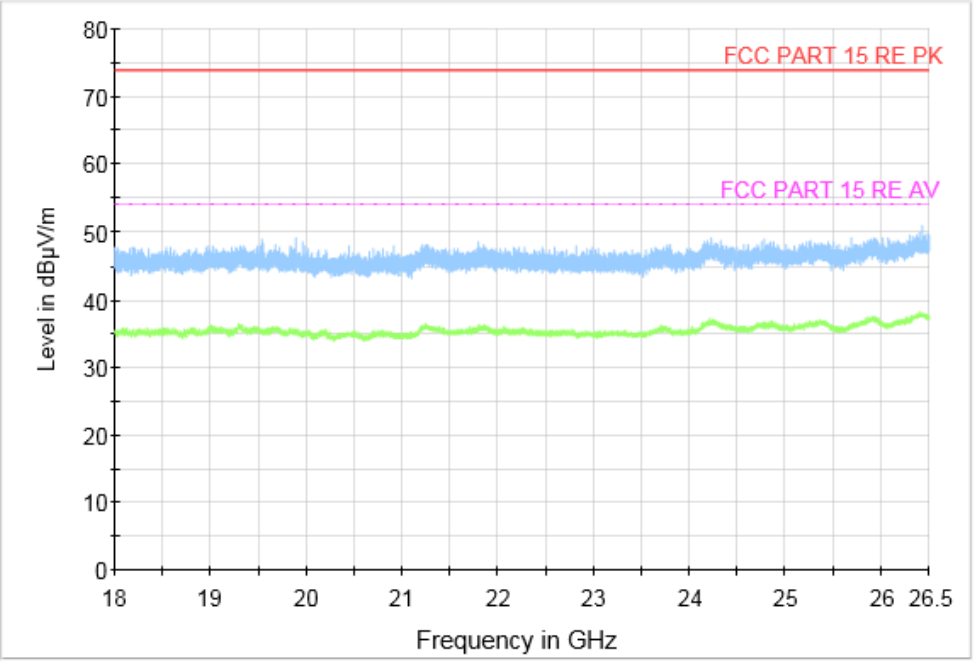

Fig.49 Radiated Spurious Emission (All Channels, 18 GHz-26.5 GHz), LE 1M

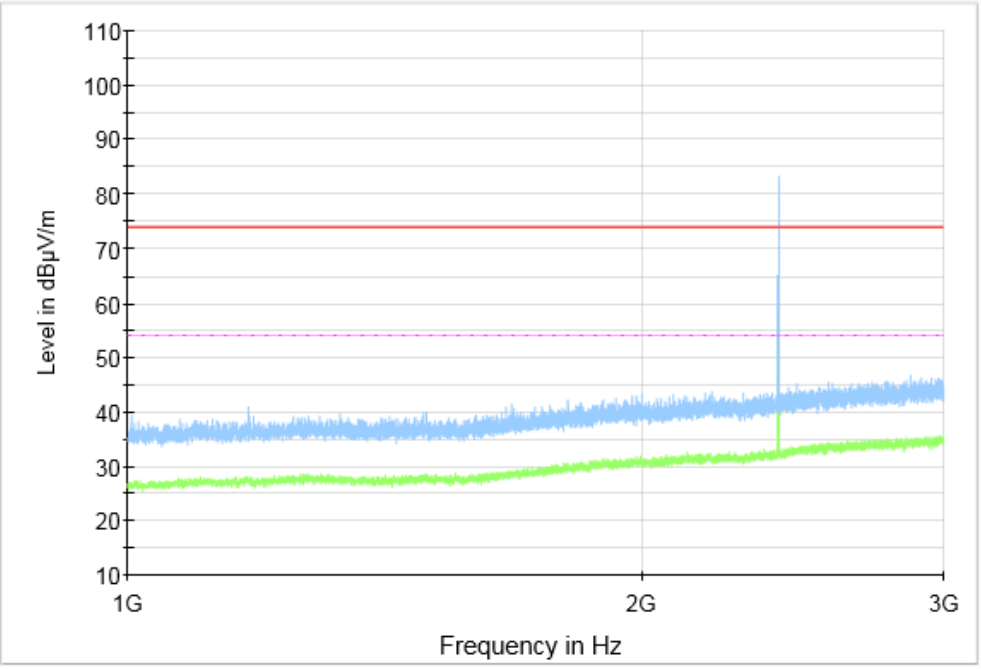

Fig.50 Radiated Spurious Emission (GFSK, Ch0, 1 GHz ~3 GHz), LE 2M

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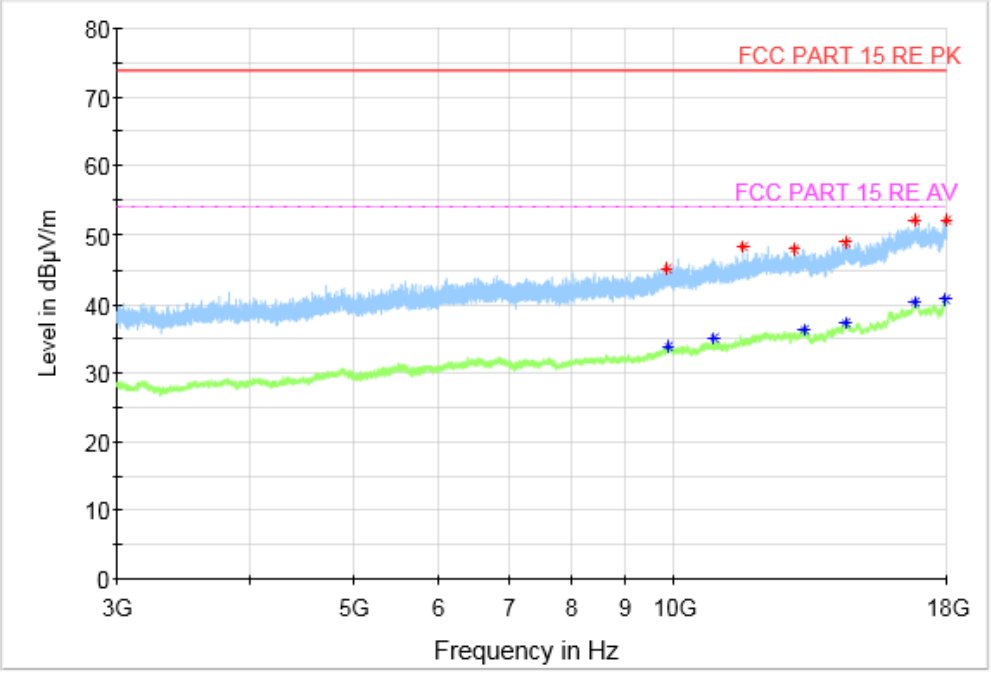

Fig.51 Radiated Spurious Emission (GFSK, Ch0, 3 GHz ~18 GHz), LE 2M

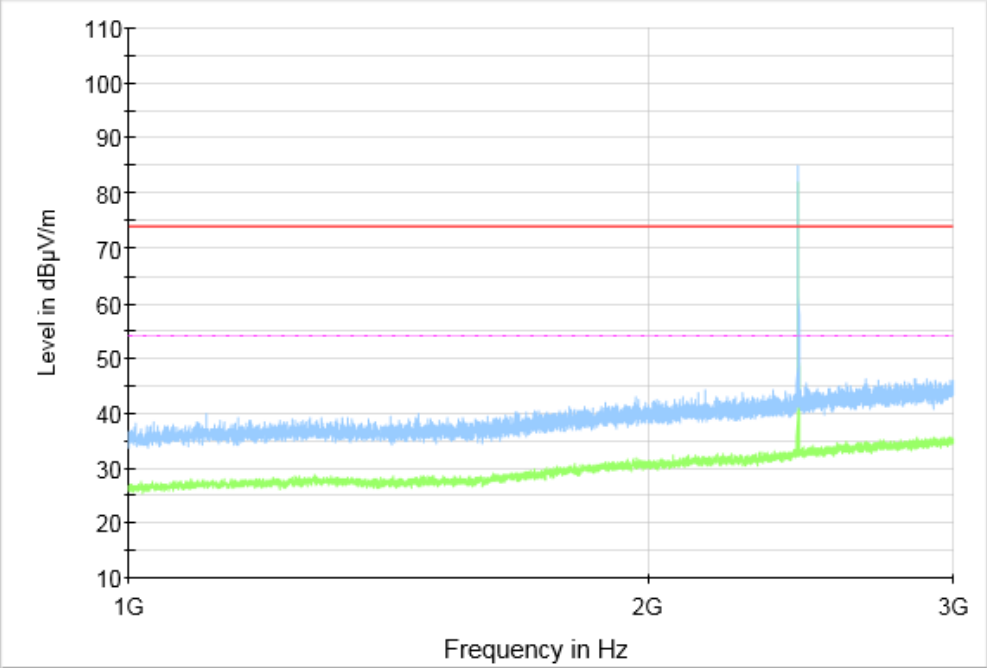

Fig.52 Radiated Spurious Emission (GFSK, Ch19, 1 GHz ~3 GHz), LE 2M

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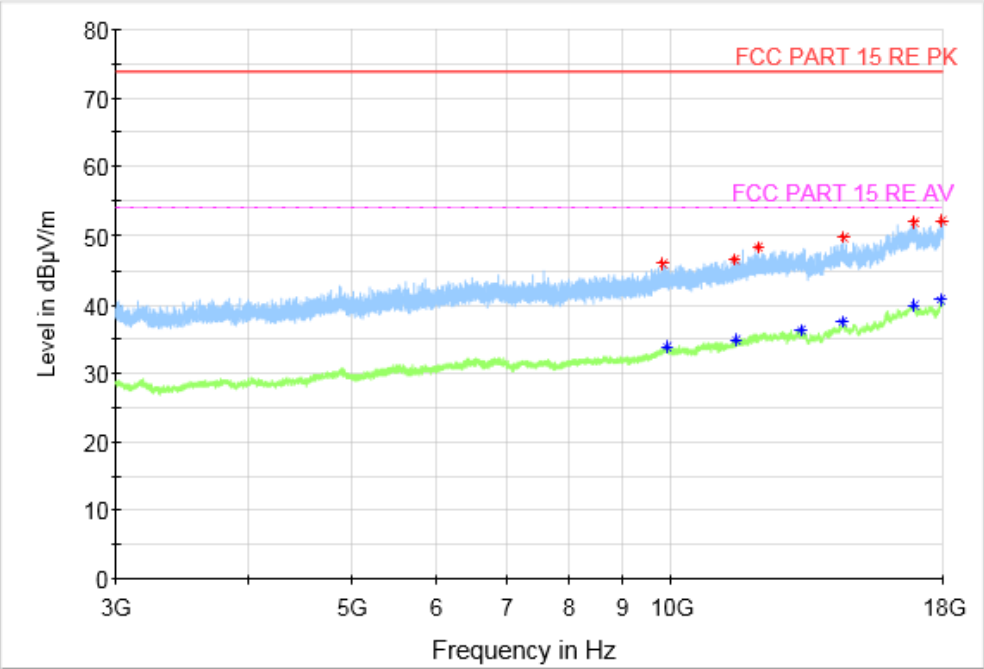

Fig.53 Radiated Spurious Emission (GFSK, Ch19, 3 GHz ~18 GHz), LE 2M

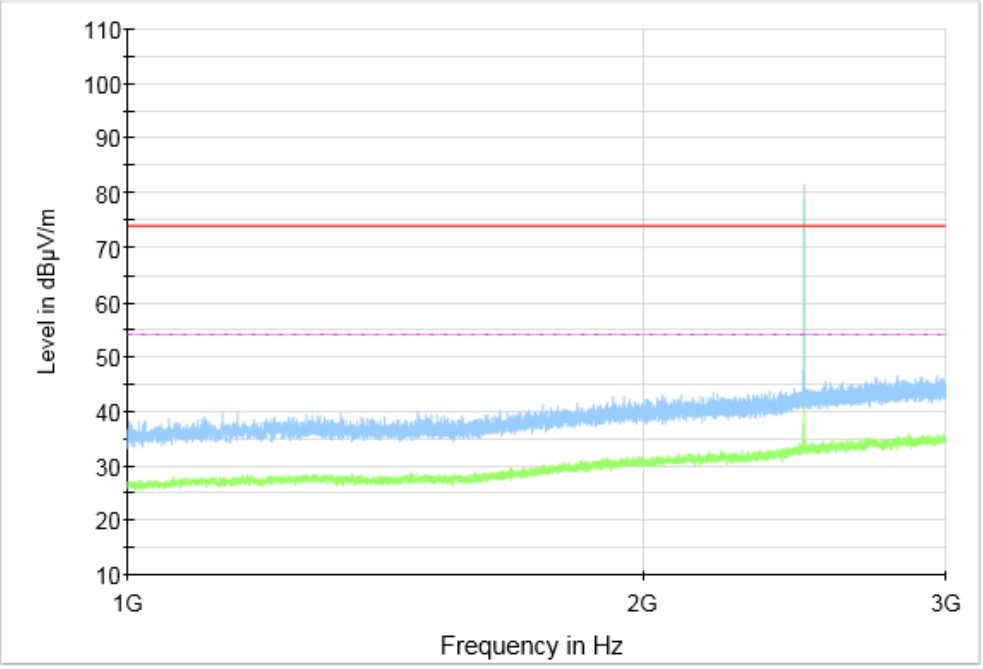

Fig.54 Radiated Spurious Emission (GFSK, Ch39, 1 GHz ~3 GHz), LE 2M

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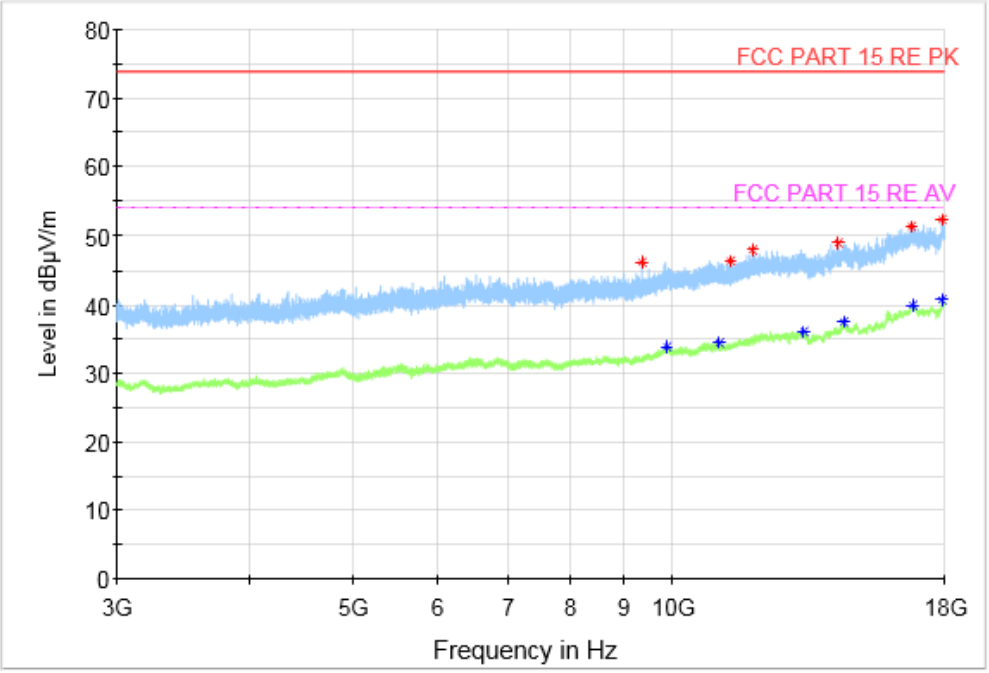

Fig.55 Radiated Spurious Emission (GFSK, Ch39, 3 GHz ~18 GHz), LE 2M

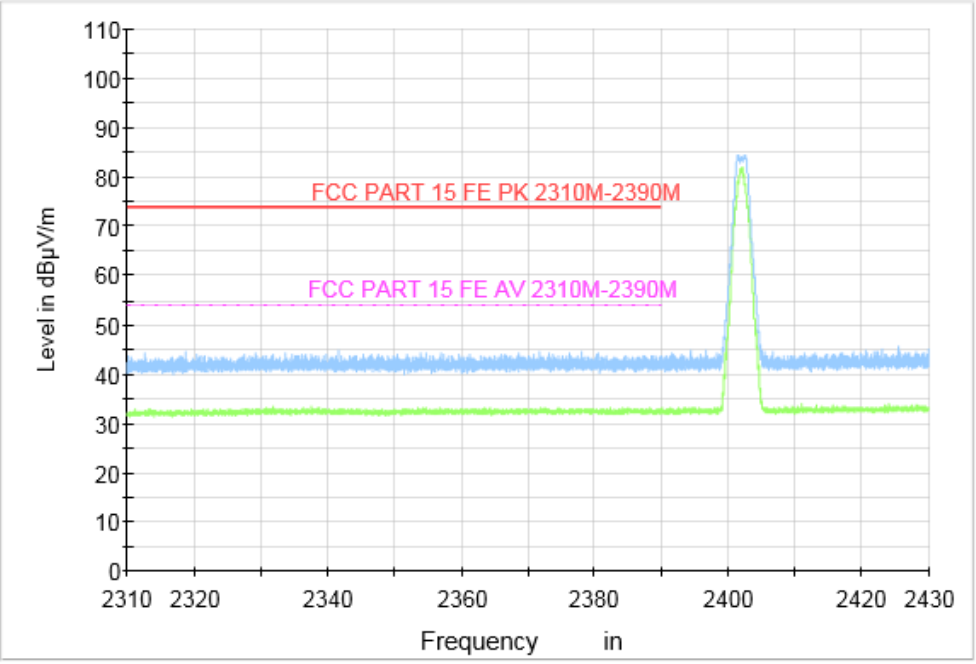

Fig.56 Radiated Band Edges (GFSK, Ch0, 2380GHz~2450GHz), LE 2M

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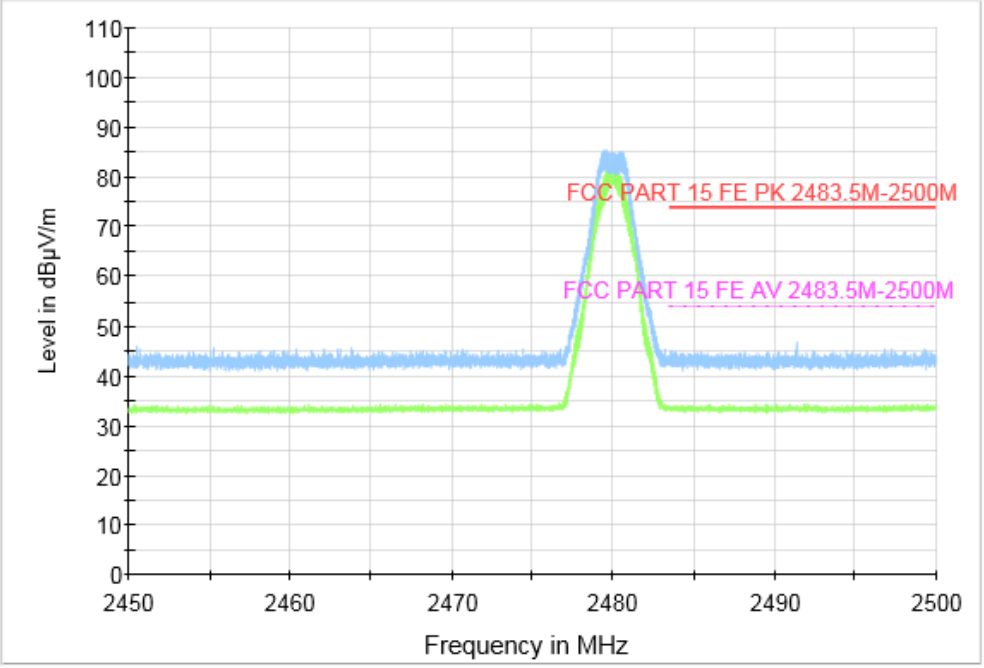

Fig.57 Radiated Band Edges (GFSK, Ch39, 2450GHz~2500GHz), LE 2M

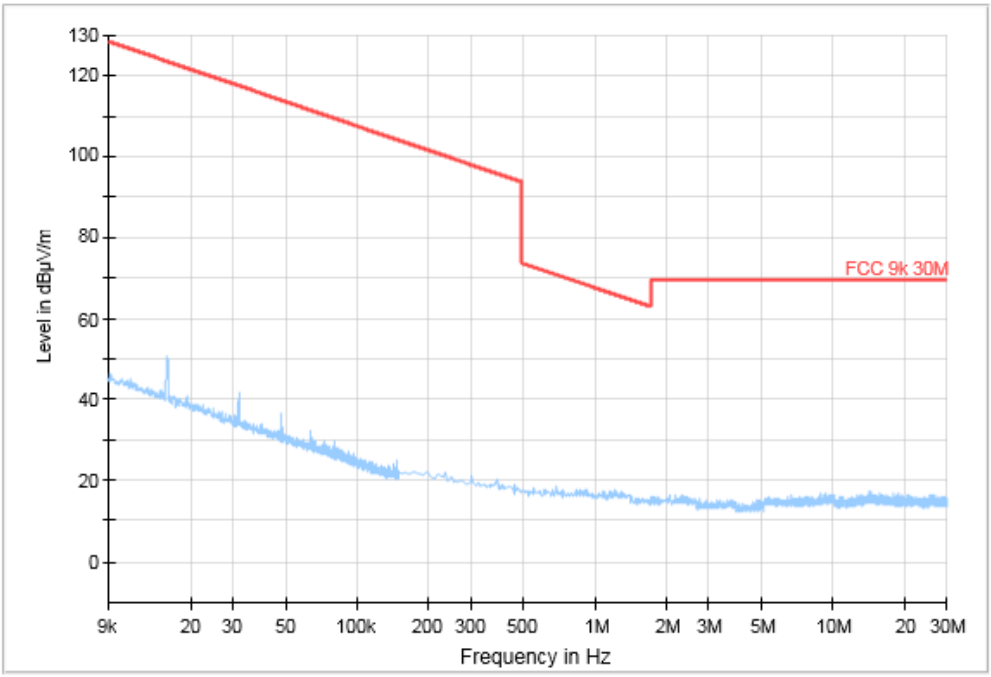

Fig.58 Radiated Spurious Emission (All Channels, 9 kHz-30 MHz), LE 2M

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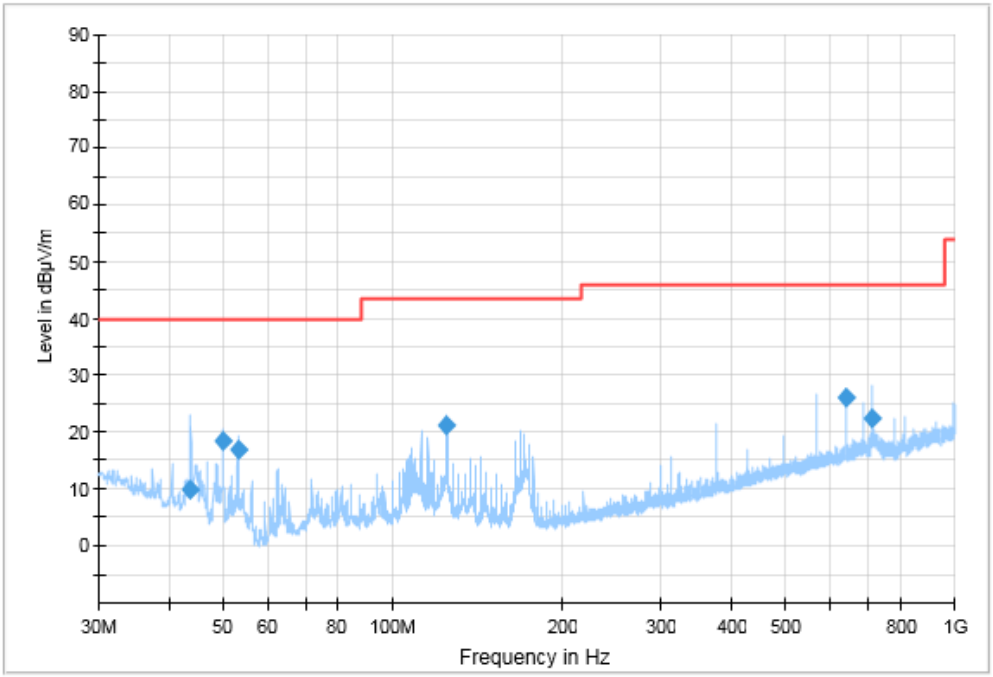

Fig.59 Radiated Spurious Emission (All Channels, 30 MHz-1 GHz), LE 2M

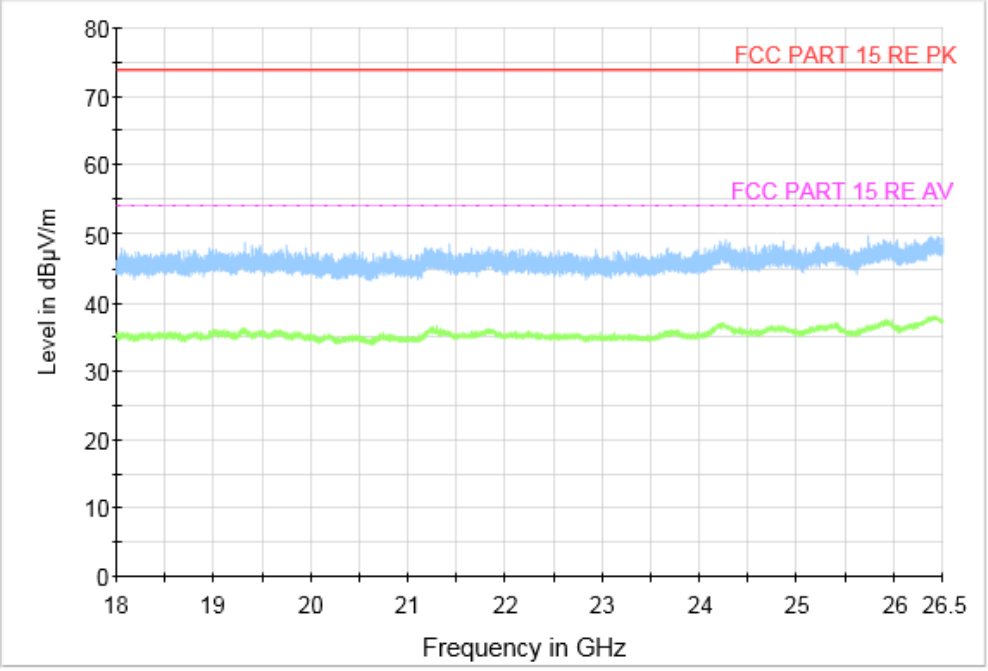

Fig.60 Radiated Spurious Emission (All Channels, 18 GHz-26.5 GHz), LE 2M

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A.7 AC Power line Conducted Emission

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Measurement Result and limit:

For LE 1M:

BLE (Quasi-peak Limit)-A2-1, A3-1

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	66 to 56	Fig.61	Fig.62	P
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

BLE (Average Limit)-A2-1, A3-1

Frequency range (MHz)	Average-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	56 to 46	Fig.61	Fig.62	P
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

For LE 2M:

BLE (Quasi-peak Limit)-A2-1, A3-1

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.16 to 0.5	66 to 56	Fig.63	Fig.64	P
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

BLE (Average Limit)-A2-1, A3-1

Frequency range (MHz)	Average-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	56 to 46	Fig.63	Fig.64	P
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

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For LE 1M:

BLE (Quasi-peak Limit)-A2-2, A3-2

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.17 to 0.5	66 to 56	Fig.65	Fig.66	**P**
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

BLE (Average Limit)-A2-2, A3-2

Frequency range (MHz)	Average-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	56 to 46	Fig.65	Fig.66	**P**
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

For LE 2M:

BLE (Quasi-peak Limit)-A2-2, A3-2

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.18 to 0.5	66 to 56	Fig.67	Fig.68	**P**
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

BLE (Average Limit)-A2-2, A3-2

Frequency range (MHz)	Average-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	56 to 46	Fig.67	Fig.68	**P**
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

Note: The measurement results include the L1 and N measurements.

See below for test graphs.

Conclusion: Pass

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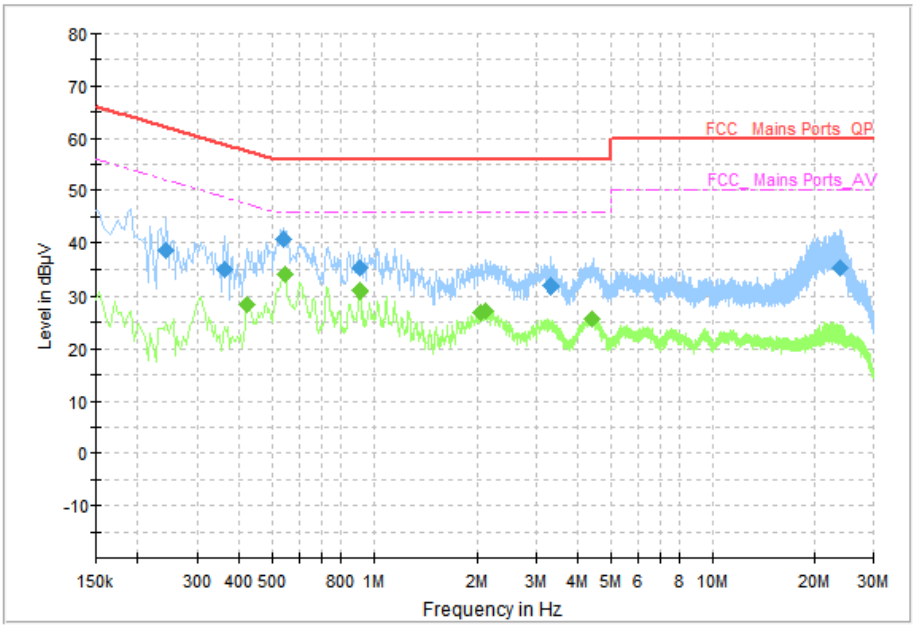

Fig.61 AC Power line Conducted Emission (Traffic), LE 1M, A2-1, A3-1

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.242000	38.40	62.03	23.62	N	ON	10
0.362000	34.82	58.68	23.87	L1	ON	10
0.542000	40.72	56.00	15.28	L1	ON	10
0.914000	35.31	56.00	20.69	L1	ON	10
3.306000	31.89	56.00	24.11	L1	ON	10
23.814000	35.19	60.00	24.81	N	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.422000	28.47	47.41	18.94	L1	ON	10
0.546000	33.91	46.00	12.09	L1	ON	10
0.910000	30.77	46.00	15.23	L1	ON	10
2.058000	26.97	46.00	19.03	L1	ON	10
2.122000	27.21	46.00	18.79	L1	ON	10
4.374000	25.60	46.00	20.40	L1	ON	10

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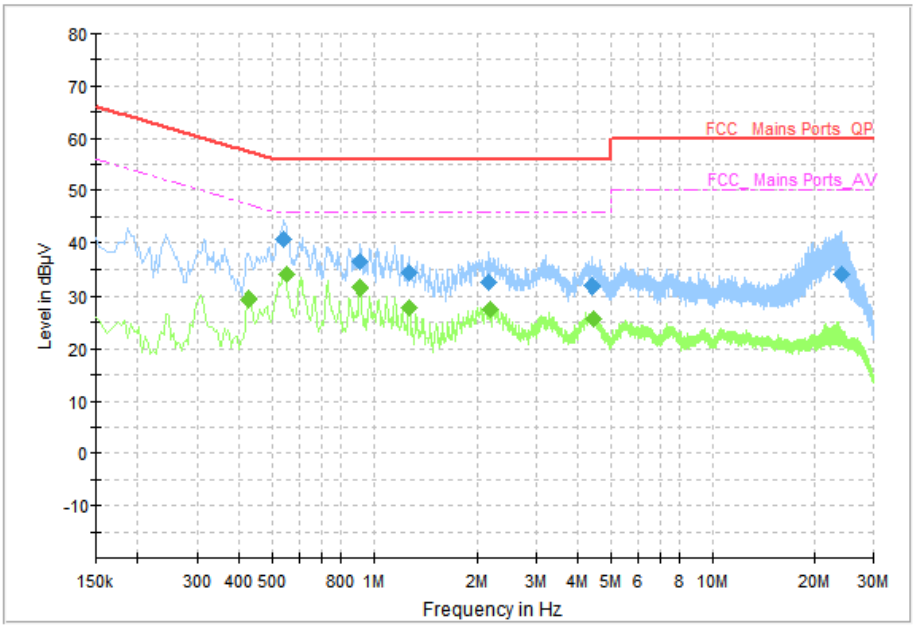

Fig.62 AC Power line Conducted Emission (Idle), LE 1M, A2-1, A3-1

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.542000	40.60	56.00	15.40	L1	ON	10
0.910000	36.42	56.00	19.58	L1	ON	10
1.274000	34.13	56.00	21.87	L1	ON	10
2.170000	32.29	56.00	23.71	L1	ON	10
4.394000	31.73	56.00	24.27	L1	ON	10
24.114000	33.94	60.00	26.06	N	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.426000	29.28	47.33	18.05	L1	ON	10
0.550000	33.92	46.00	12.09	L1	ON	10
0.910000	31.63	46.00	14.37	L1	ON	10
1.274000	27.99	46.00	18.01	L1	ON	10
2.186000	27.59	46.00	18.41	L1	ON	10
4.442000	25.70	46.00	20.30	L1	ON	10

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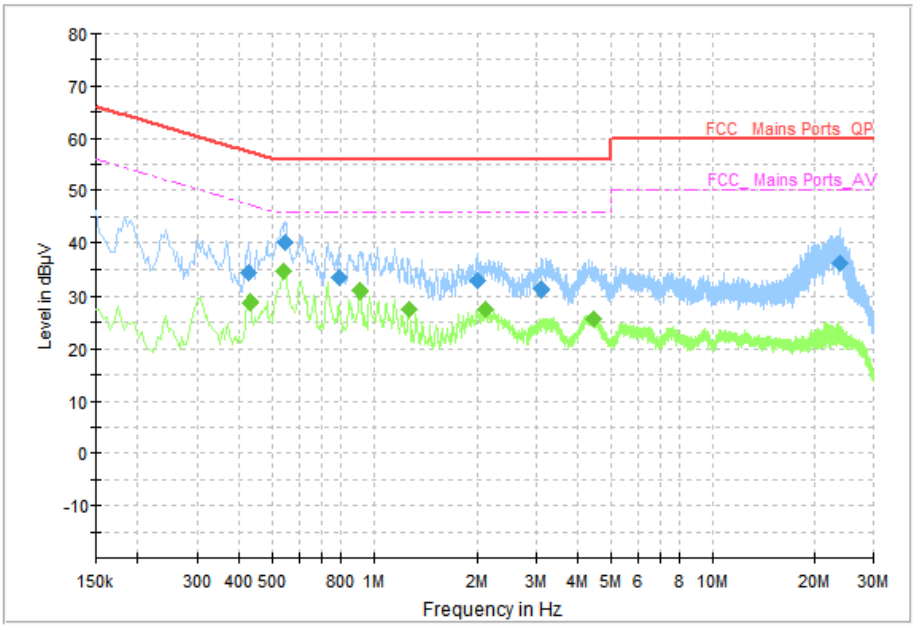

Fig.63 AC Power line Conducted Emission (Traffic), LE 2M, A2-1, A3-1

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.426000	34.33	57.33	23.00	N	ON	10
0.546000	40.15	56.00	15.85	L1	ON	10
0.786000	33.30	56.00	22.70	L1	ON	10
2.010000	32.68	56.00	23.32	L1	ON	10
3.102000	31.34	56.00	24.66	L1	ON	10
23.882000	36.04	60.00	23.96	N	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.430000	28.69	47.25	18.56	L1	ON	10
0.542000	34.63	46.00	11.37	L1	ON	10
0.906000	30.87	46.00	15.13	L1	ON	10
1.274000	27.67	46.00	18.33	L1	ON	10
2.126000	27.47	46.00	18.53	L1	ON	10
4.426000	25.65	46.00	20.35	L1	ON	10

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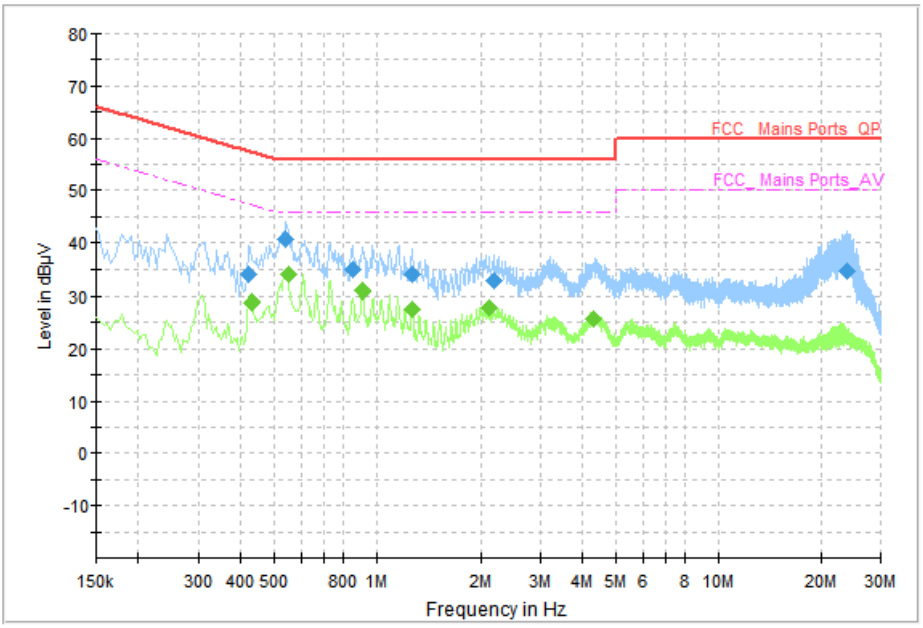

Fig.64 AC Power line Conducted Emission (Idle), LE 2M, A2-1, A3-1

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.422000	34.11	57.41	23.30	N	ON	10
0.542000	40.64	56.00	15.36	L1	ON	10
0.850000	35.01	56.00	20.99	L1	ON	10
1.274000	34.09	56.00	21.91	L1	ON	10
2.194000	32.80	56.00	23.20	L1	ON	10
23.774000	34.58	60.00	25.42	N	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.430000	28.84	47.25	18.42	L1	ON	10
0.550000	33.99	46.00	12.01	L1	ON	10
0.906000	31.06	46.00	14.94	L1	ON	10
1.270000	27.68	46.00	18.32	L1	ON	10
2.122000	27.75	46.00	18.25	L1	ON	10
4.318000	25.84	46.00	20.16	L1	ON	10

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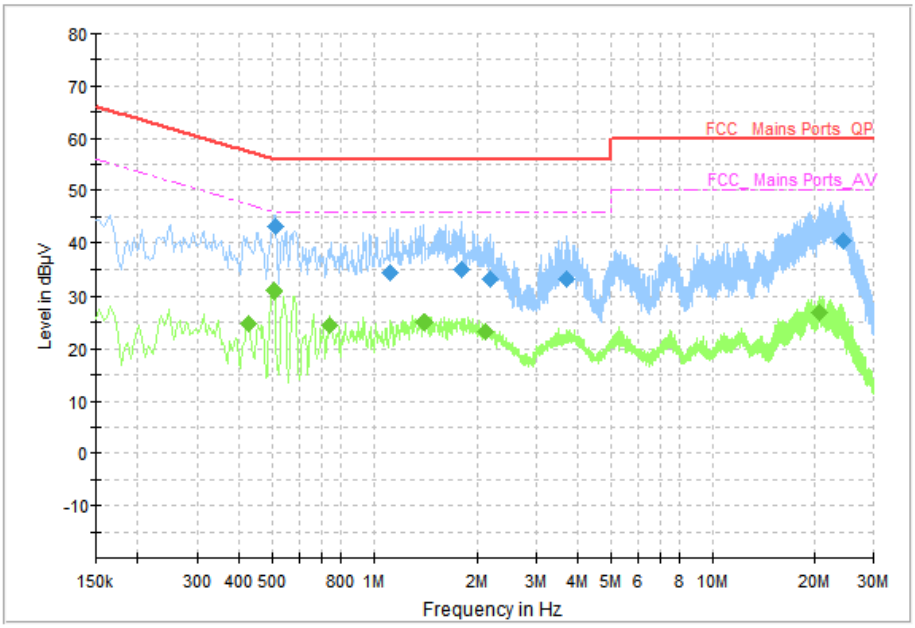

Fig.65 AC Power line Conducted Emission (Traffic), LE 1M, A2-2, A3-2

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.510000	43.18	56.00	12.82	L1	ON	10
1.122000	34.20	56.00	21.80	L1	ON	10
1.810000	34.77	56.00	21.23	L1	ON	10
2.202000	33.13	56.00	22.87	L1	ON	10
3.686000	32.94	56.00	23.06	L1	ON	10
24.298000	40.32	60.00	19.68	L1	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.426000	24.81	47.33	22.52	L1	ON	10
0.506000	30.88	46.00	15.12	L1	ON	10
0.742000	24.55	46.00	21.45	L1	ON	10
1.410000	25.02	46.00	20.98	N	ON	10
2.126000	23.25	46.00	22.75	N	ON	10
20.782000	26.83	50.00	23.17	L1	ON	10

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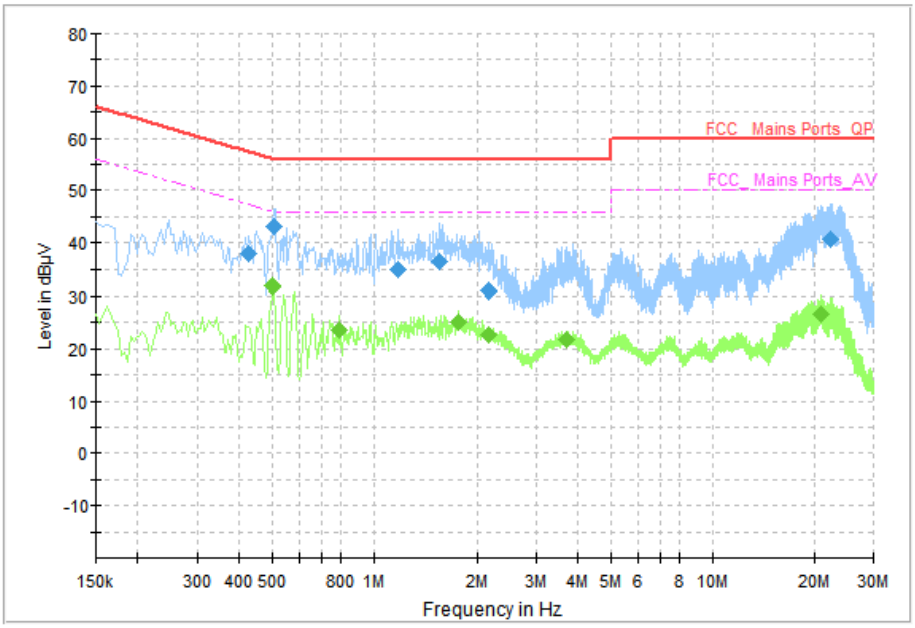

Fig.66 AC Power line Conducted Emission (Idle), LE 1M, A2-2, A3-2

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.426000	37.95	57.33	19.38	L1	ON	10
0.506000	43.07	56.00	12.93	L1	ON	10
1.182000	34.92	56.00	21.08	L1	ON	10
1.554000	36.28	56.00	19.72	L1	ON	10
2.166000	31.00	56.00	25.00	L1	ON	10
22.274000	40.80	60.00	19.20	L1	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.502000	31.75	46.00	14.25	N	ON	10
0.786000	23.69	46.00	22.31	L1	ON	10
1.766000	24.99	46.00	21.01	N	ON	10
2.174000	22.76	46.00	23.24	N	ON	10
3.686000	21.77	46.00	24.23	L1	ON	10
20.874000	26.77	50.00	23.23	L1	ON	10

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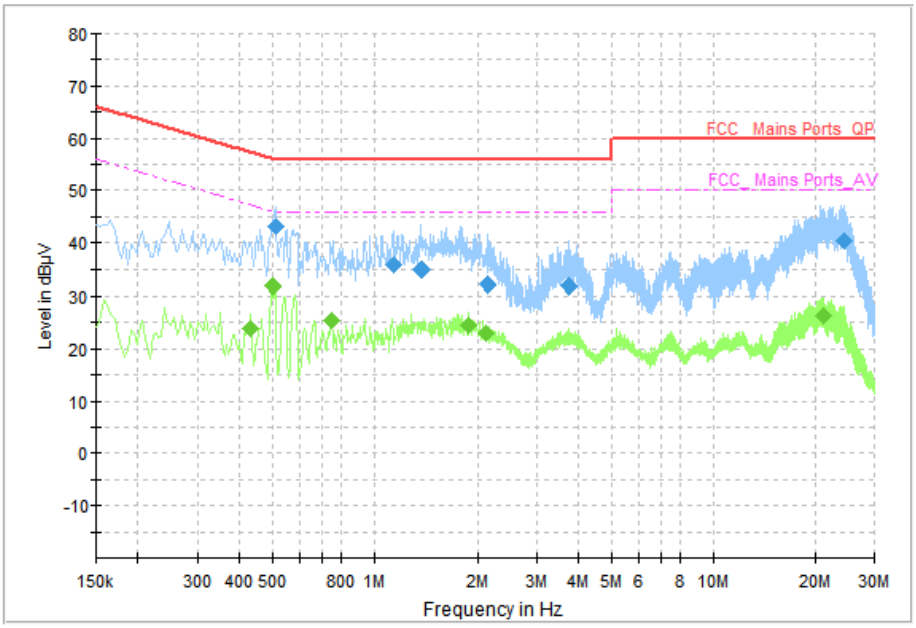

Fig.67 AC Power line Conducted Emission (Traffic), LE 2M, A2-2, A3-2

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.510000	43.09	56.00	12.91	L1	ON	10
1.142000	35.66	56.00	20.34	L1	ON	10
1.378000	34.82	56.00	21.18	L1	ON	10
2.134000	32.24	56.00	23.76	L1	ON	10
3.718000	31.76	56.00	24.24	L1	ON	10
24.318000	40.42	60.00	19.58	L1	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.430000	24.04	47.25	23.22	L1	ON	10
0.502000	31.70	46.00	14.30	N	ON	10
0.746000	25.43	46.00	20.57	L1	ON	10
1.878000	24.40	46.00	21.60	N	ON	10
2.122000	23.10	46.00	22.90	N	ON	10
21.090000	26.37	50.00	23.63	L1	ON	10

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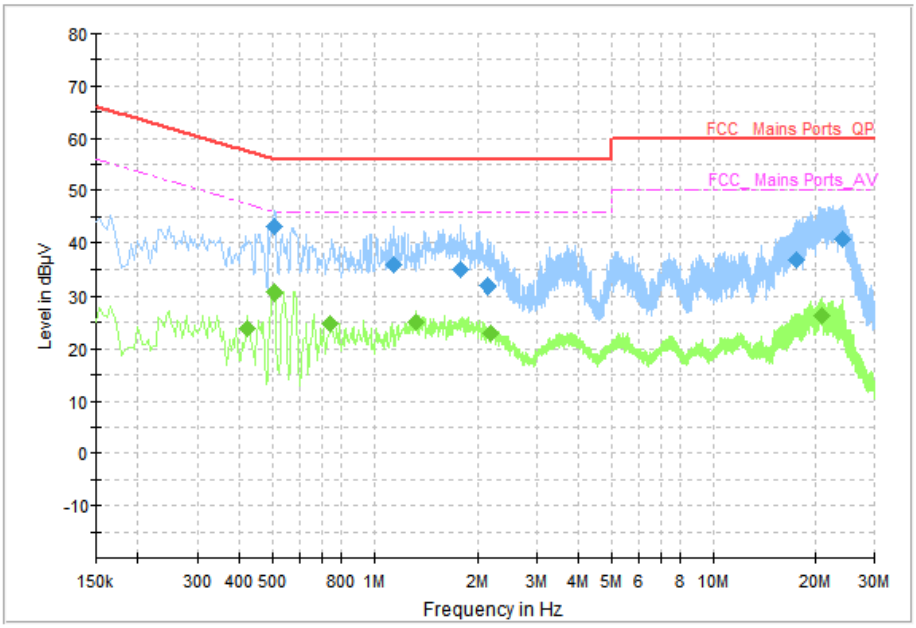

Fig.68 AC Power line Conducted Emission (Idle), LE 2M, A2-2, A3-2

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.506000	43.14	56.00	12.86	L1	ON	10
1.138000	35.66	56.00	20.34	L1	ON	10
1.786000	35.01	56.00	20.99	L1	ON	10
2.138000	31.87	56.00	24.13	L1	ON	10
17.634000	36.85	60.00	23.15	L1	ON	10
24.014000	40.81	60.00	19.19	L1	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.422000	23.96	47.41	23.45	L1	ON	10
0.506000	30.55	46.00	15.45	N	ON	10
0.742000	24.72	46.00	21.28	L1	ON	10
1.330000	25.11	46.00	20.89	N	ON	10
2.182000	23.14	46.00	22.86	N	ON	10
20.882000	26.44	50.00	23.56	L1	ON	10

*****END OF REPORT*****

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