FCC PART 15C
TEST REPORT
No. 2013EEB00520-BT(BLE)

For

BDE Technology Co., Ltd.

BDE Bluetooth 4.0 Single Mode HCI Module

Model Name: BDE-BLEM101A

Marketing Name: BDE-BLEM101A

With

Hardware Version: 1.1

Software Version: 08

FCC ID: 2ABRUBDLEM101A

Issued Date: Feb 27th, 2014

Test Laboratory:
FCC 2.948 Listed: No.310359
IC O.A.T.S listed: No.6629C-1

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 TMC Beijing.

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CONTENTS

1. Test Laboratory

1.1. Testing Location

Company Name:	TMC Shenzhen, Telecommunication Metrology Center of MIIT
Address:	No. 12 Building, Shangsha Innovation and Technology Park, Futian District, Shenzhen, P. R. China
Postal Code:	518048
Telephone:	+86(0)755-33322000
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1.2. Testing Environment

Normal Temperature:	15℃-30℃
Extreme Temperature:	-20℃/+55℃
Relative Humidity:	30%-60%

1.3. Project data

Project Leader:	Zhang Bojun
Test Engineer:	Tang Weisheng
Testing Start Date:	Oct 16th, 2013
Testing End Date:	Nov 26th, 2013

1.4. Signature

Tang Weisheng
(Prepared this test report)

Zhang Bojun
(Reviewed this test report)

Lu Minniu
Director of the laboratory
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	BDE Technology Co., Ltd.
Address /Post:	Innovation Building C1-1105, 182 Science Ave, Science City Guangzhou, P.R.China
City:	Guangzhou
Postal Code:	510663
Country:	China
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2.2. Manufacturer Information

Company Name:	BDE Technology Co., Ltd.
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Postal Code:	510663
Country:	China
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E-mail:	xwu@bdecomm.com
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	BDE Bluetooth 4.0 Single Mode HCI Module
Model Name	BDE-BLEM101A
Market Name	BDE-BLEM101A
Type of Modulation	GFSK
FCC ID	2ABRUBDLEM101A

Note: Photographs of EUT are shown in ANNEX A of this test report.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version
EUT1	/	1.1	08

3.3. Internal Identification of AE used during the test

AE ID*	Description	Type	SN
/	/	/	/

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

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 Part15	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.	Oct, 2012 Edition
ANSI C63.4	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2009
KDB558074	Measurement of Digital Transmission Systems Operating under Section 15.247	April, 2013

5. Laboratory Environment

Half-anechoic chamber (11.20 meters×6.10 meters×5.60 meters) did not exceed following limits:

Temperature	Min. = 15 ℃, Max. = 30 ℃
Relative humidity	Min. = 30 %, Max. = 60 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 0.5 Ω
Normalized Site Attenuation (NSA)	< ±3.5dB, with 3m of Measuring distance, 30MHz 1000MHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

Fully-anechoic chamber (11.20 meters×6.10 meters×6.60 meters) did not exceed following limits:

Temperature	Min. = 15 ℃, Max. = 30 ℃
Relative humidity	Min. = 30 %, Max. = 60 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 30MHz to 18 000 MHz

Conduction Lab did not exceed following limits:

Temperature	Min.=15 ℃, Max.=30 ℃
Relative humidity	Min.=30 %, Max.= 60 %
Shielding effectiveness	> 80 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 0.5 Ω

6. Summary of Test Results

6.1. Summary of Test Results

No	Test cases	Sub-clause of Part15C	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 Powerline Conducted Emission	15.207	**P**

6.2. Statements

TMC has evaluated the test cases requested by the applicant/manufacturer as listed in section 6.1 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2

6.3. Terms used in the result table

Terms used in Verdict column

P	Pass
NA	Not Available
F	Fail

Abbreviations

AC	Alternating Current
AFH	Adaptive Frequency Hopping
BW	Band Width
E.I.R.P.	equivalent isotropical radiated power
ISM	Industrial, Scientific and Medical
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
Tx	Transmitter

7. 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	2014-04-23	1 year

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Chamber	FACT5-2.0	4166	ETS-Lindgren	2016-05-29	3 years
2	Test Receiver	ESCI	100701	Rohde & Schwarz	2014-07-31	1 year
3	Spectrum Analyzer	FSP40	100378	Rohde & Schwarz	2013-12-21	1 year
4	BiLog Antenna	VULB9163	9163-330	Schwarzbeck	2014-02-24	3 years
5	Dual-Ridge Waveguide Horn Antenna	3164-05	00085724	ETS-Lindgren	2014-02-17	3 years
6	Test Receiver	ESCI	100702	Rohde & Schwarz	2014-07-31	1 year
7	LISN	ESH2-Z5	100196	Rohde & Schwarz	2014-01-23	1 year
8	Signal Generator	SMR40	100541	Rohde & Schwarz	2014-01-10	1 year
9	Dual-Ridge Waveguide Horn Antenna	3117	00066577	ETS-Lindgren	2016-04-01	3 years
10	Loop Antenna	HLA6120	35779	TESEQ	2016-02-25	3 years
11	EMI Antenna	3160-09	00118383	ETS-Lindgren	2015-09-05	3 years

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren.

ANNEX A: EUT photograph

Pic A-1 Module

Pic A-2 Module

ANNEX B: MEASUREMENT RESULTS

B.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 0.5 dBi.
The RF transmitter uses an integrate antenna without connector.

B.1 Maximum Peak Output Power

Measurement Limit and Method:

Standard	Limit (dBm)
FCC CRF Part 15.247(b)(1)	< 30

Measurement Results:

Mode	Channel	Maximum Peak Output Power（dBm）		Conclusion
GFSK	0	Fig.1	0.86	P
	19	Fig.2	0.92	P
	39	Fig.3	1.28	P

See ANNEX C for test graphs.

Conclusion: Pass

B.2 Peak Power Spectral Density

Measurement Limit:

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

Measurement Results:

Mode	Channel	Peak Power Spectral Density（dBm）		Conclusion
GFSK	0	Fig.4	-13.97	P
	19	Fig.5	-14.01	P
	39	Fig.6	-13.71	P

See ANNEX C for test graphs.

Conclusion: Pass

B.3 Occupied 6dB Bandwidth

Measurement Limit:

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

Measurement Result:

Mode	Channel	Test Results (kHz)		conclusion
GFSK	0	Fig.7	694.6	P
	19	Fig.8	687.4	P
	39	Fig.9	701.9	P

See ANNEX C for test graphs.

Conclusion: Pass

B.4 Band Edges Compliance

Measurement Limit:

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

Measurement Result:

Mode	Channel	Test Results	Conclusion
GFSK	0	Fig.10	P
	39	Fig.11	P

See ANNEX C for test graphs.

Conclusion: Pass

B.5 Transmitter Spurious Emission

B.5.1 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
GFSK	0	2.402 GHz	Fig.12	P
		30 MHz-3 GHz	Fig.13	P
		3GHz-18GHz	Fig.14	P
	19	2.440 GHz	Fig.15	P
		30 MHz-3 GHz	Fig.16	P
		3GHz-18GHz	Fig.17	P
	39	2.480 GHz	Fig.18	P
		30 MHz-3 GHz	Fig.19	P
		3GHz-18GHz	Fig.20	P
	All channels	18GHz-26GHz	Fig.21	P

See ANNEX C for test graphs.

Conclusion: Pass

B.5.2 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	100KHz/300KHz	5
1000-4000	1MHz/1MHz	15
4000-18000	1MHz/1MHz	40
18000-26500	1MHz/1MHz	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.

Measurement Results:

Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	30 MHz ~1 GHz	Fig.22	P
		1 GHz ~ 3 GHz	Fig.23	P
		3 GHz ~ 18 GHz	Fig.24	P
	19	30 MHz ~1 GHz	Fig.25	P
		1 GHz ~ 3 GHz	Fig.26	P
		3 GHz ~ 18 GHz	Fig.27	P
	39	30 MHz ~1 GHz	Fig.28	P
		1 GHz ~ 3 GHz	Fig.29	P
		3 GHz ~ 18 GHz	Fig.30	P
/	All channels	18 GHz~ 26.5 GHz	Fig.31	P

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”, and including the gain of receive antenna, 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}+$A_{Rpl=}$ P_{Mea}+Cable Loss+Antenna Factor

See ANNEX C for test graphs.

Conclusion: Pass

B.6 AC Powerline Conducted Emission

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Measurement Result and limit:

BLE (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	66 to 56	Fig.32	Fig.33	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)

Frequency range (MHz)	Average-peak Limit (dBμV)	Result (dBμV)		Conclusion
		Traffic	Idle	
0.15 to 0.5	56 to 46	Fig.32	Fig.33	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 ANNEX C for test graphs.

Conclusion: Pass

ANNEX C: TEST FIGURE LIST

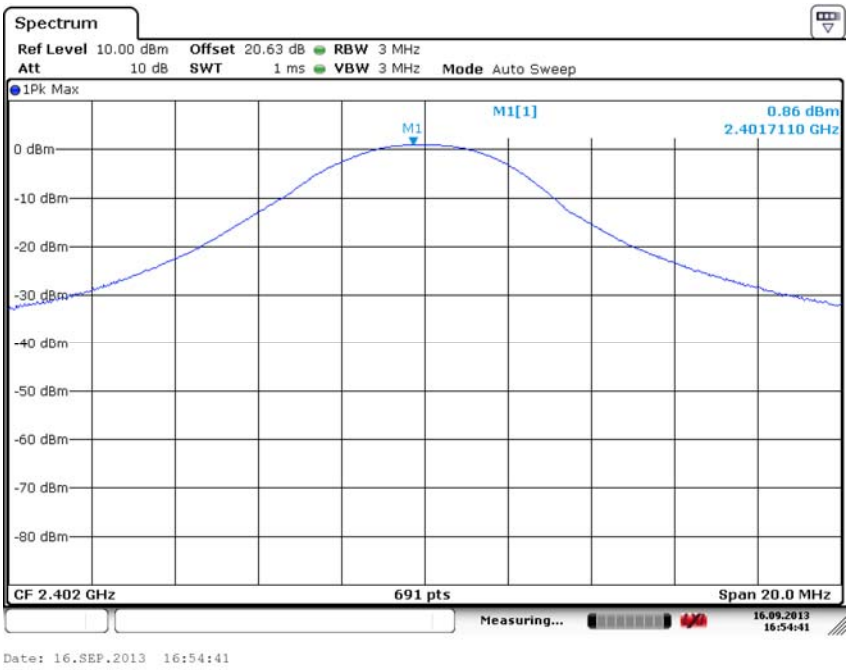

Fig. 1 Maximum Peak Output Power (Ch 0)

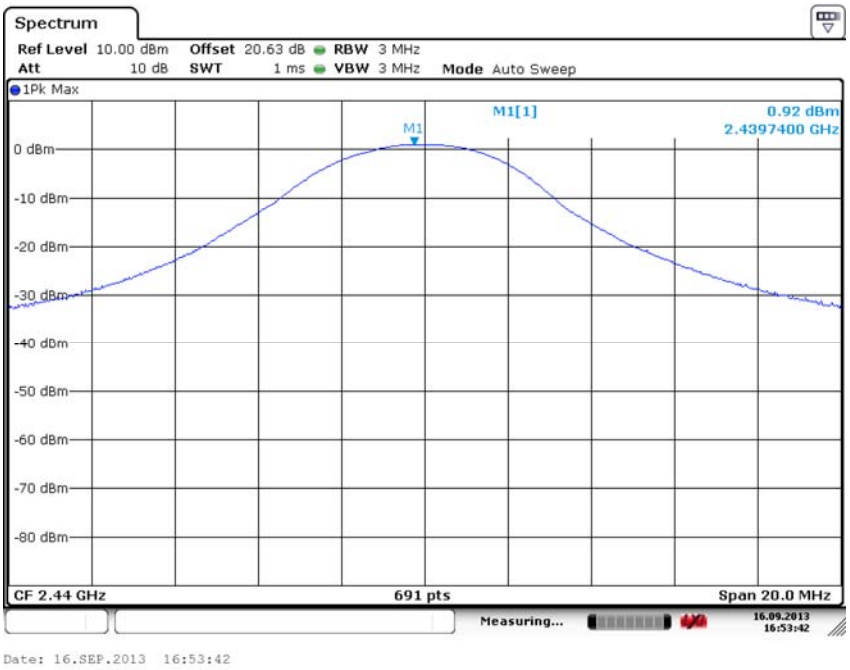

Fig. 2 Maximum Peak Output Power (Ch 19)

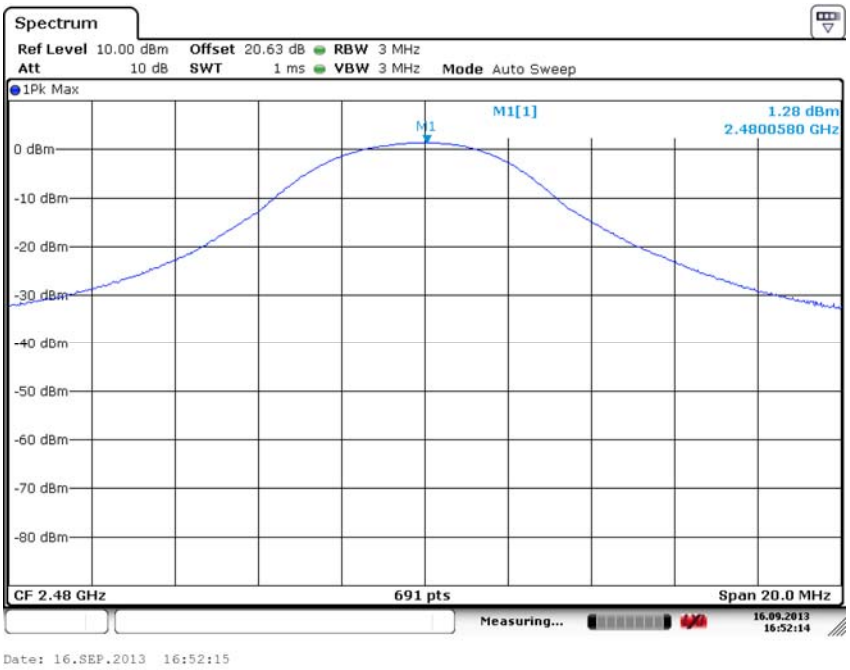

Fig. 3 Maximum Peak Output Power (Ch 39)

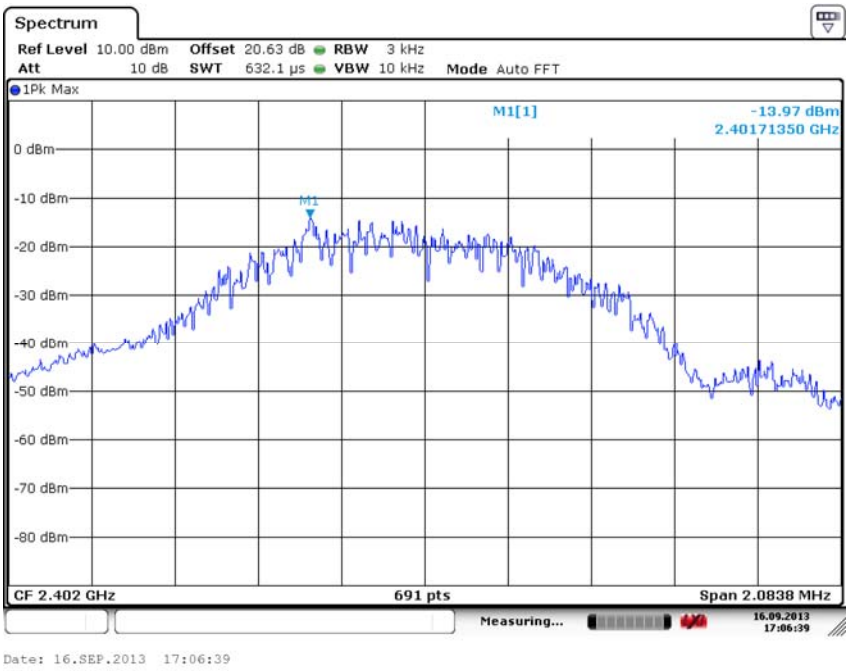

Fig. 4 Power Spectral Density (Ch 0)

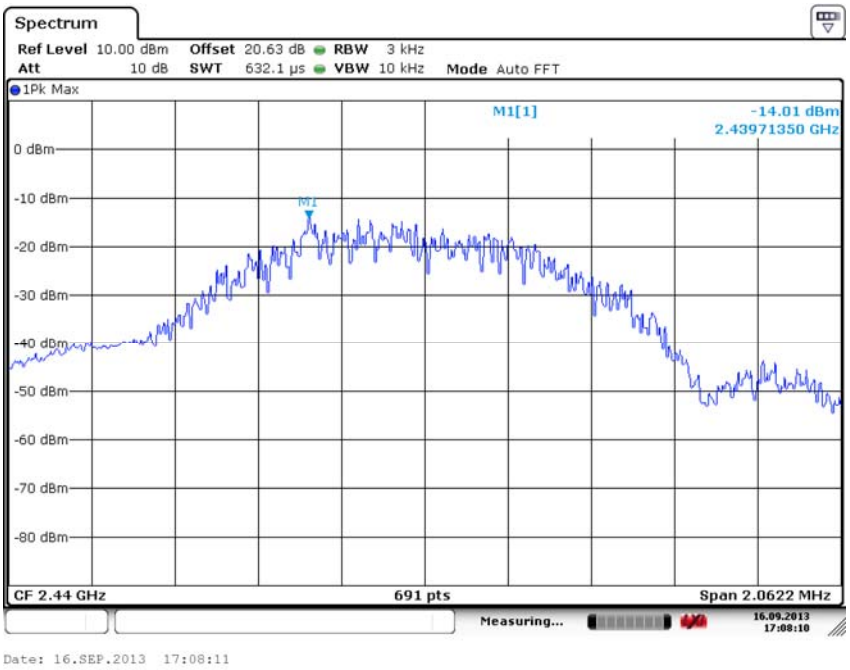

Fig. 5 Power Spectral Density (Ch 19)

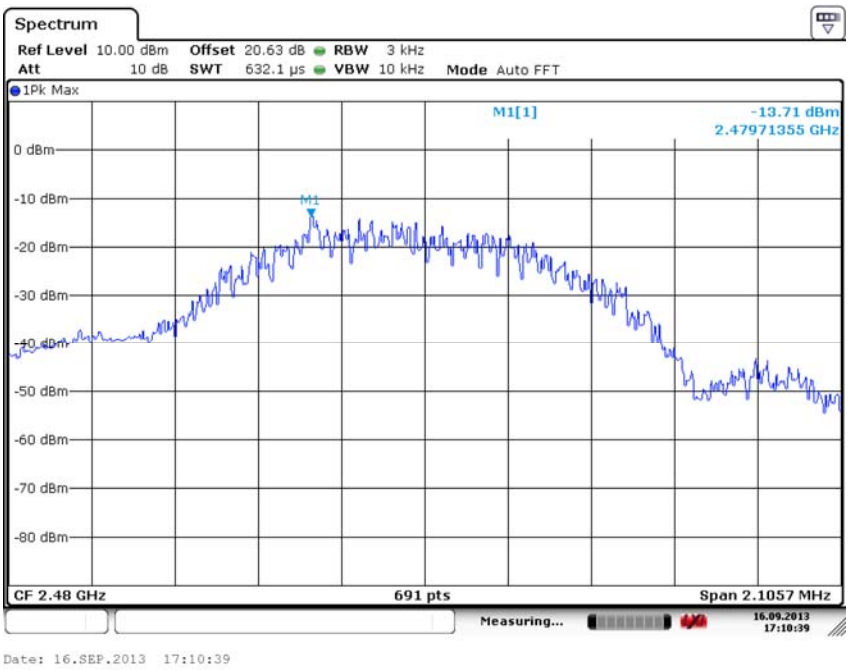

Fig. 6 Power Spectral Density (Ch 39)

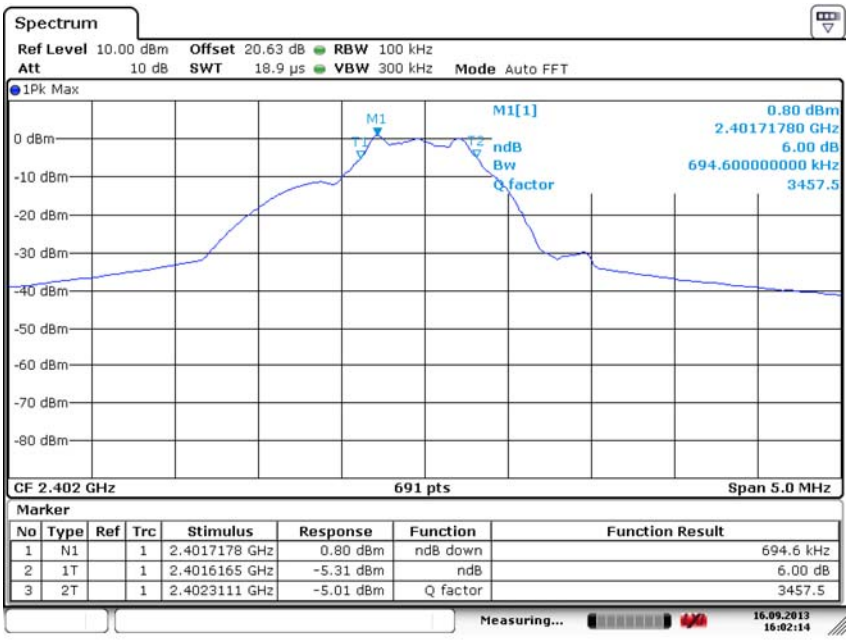

Fig. 7 Occupied 6dB Bandwidth (Ch 0)

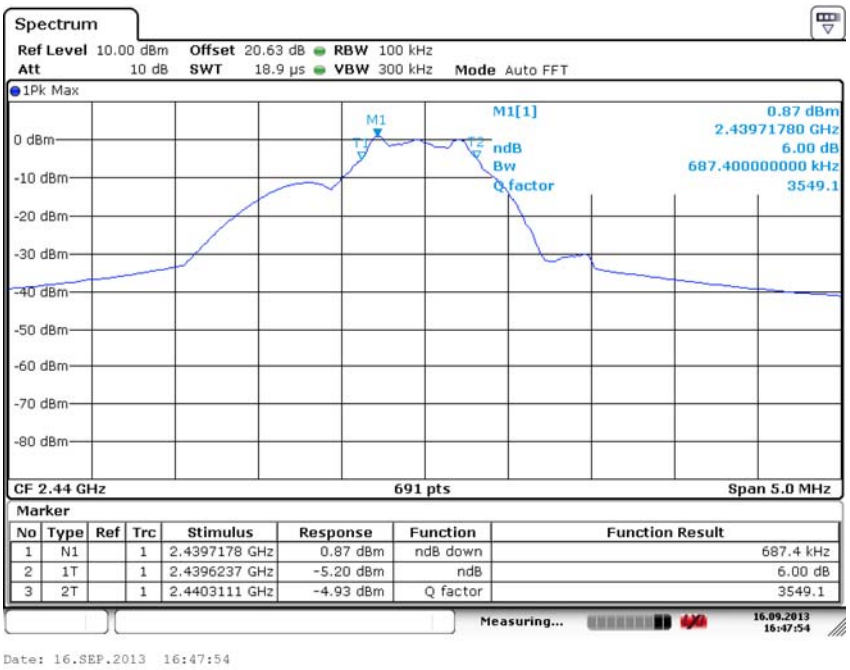

Fig. 8 Occupied 6dB Bandwidth (Ch 19)

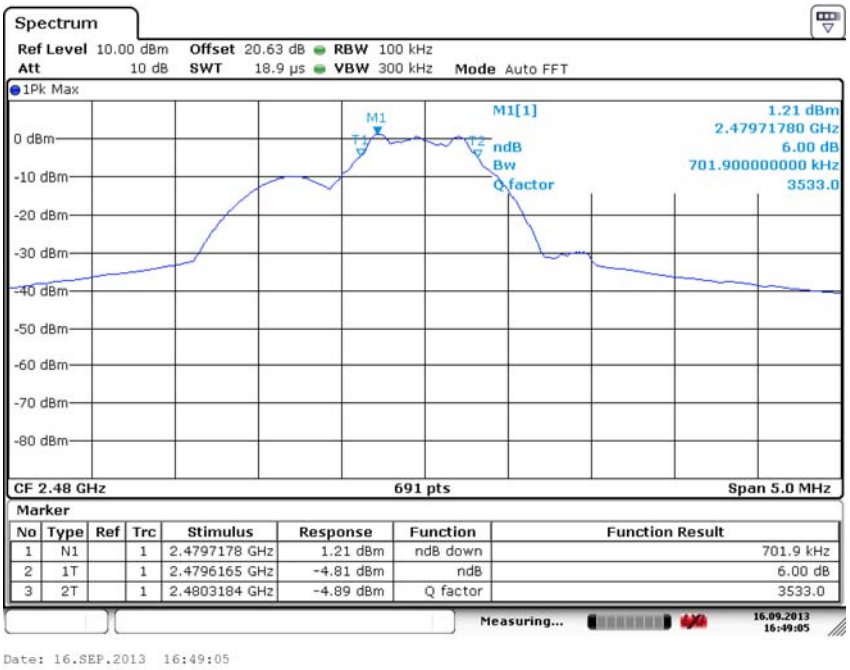

Fig. 9 Occupied 6dB Bandwidth (Ch 39)

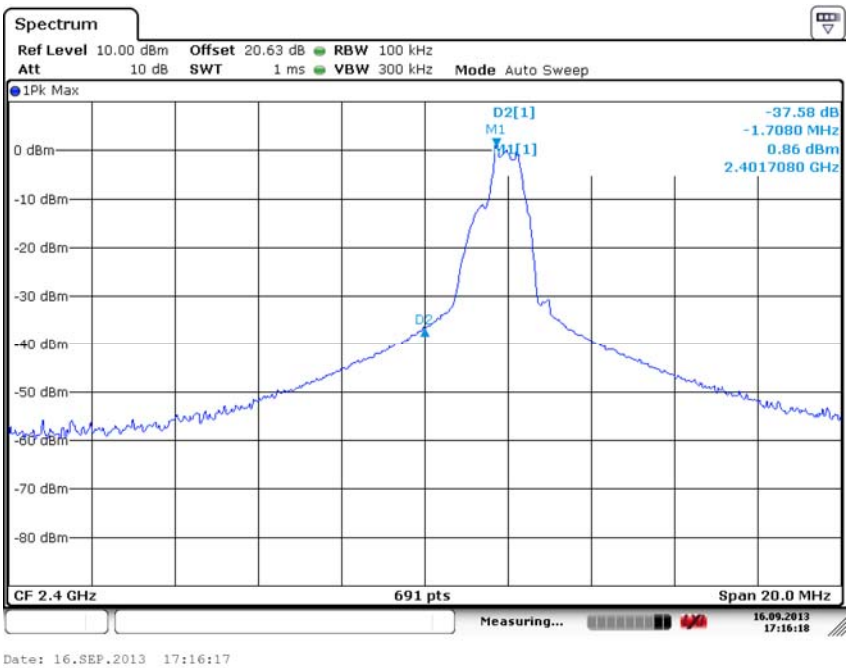

Fig. 10 Band Edges (Ch 0)

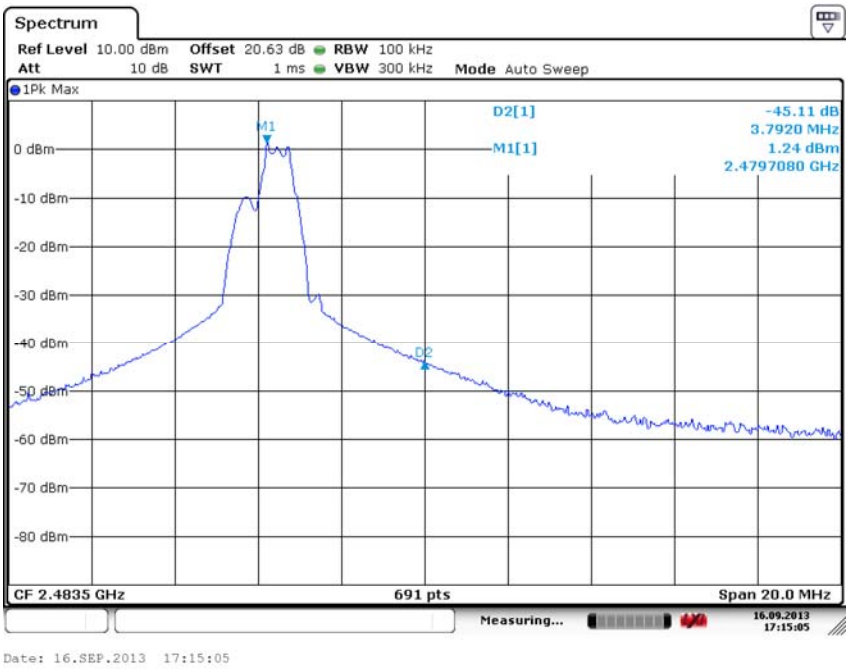

Fig. 11 Band Edges (Ch 39)

Fig. 12 Conducted Spurious Emission (Ch0, Center Frequency)

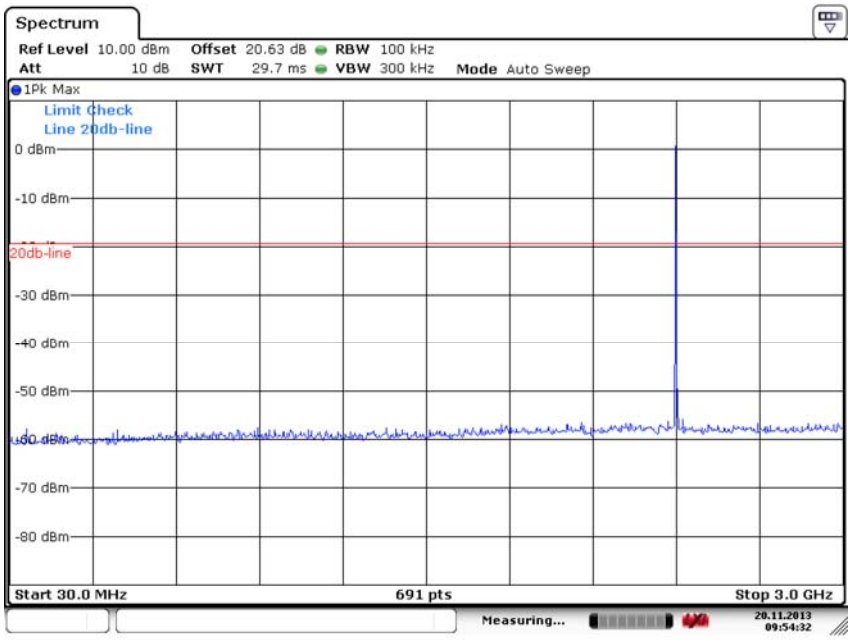

Fig. 13 Conducted Spurious Emission (Ch0, 30 MHz-3 GHz)

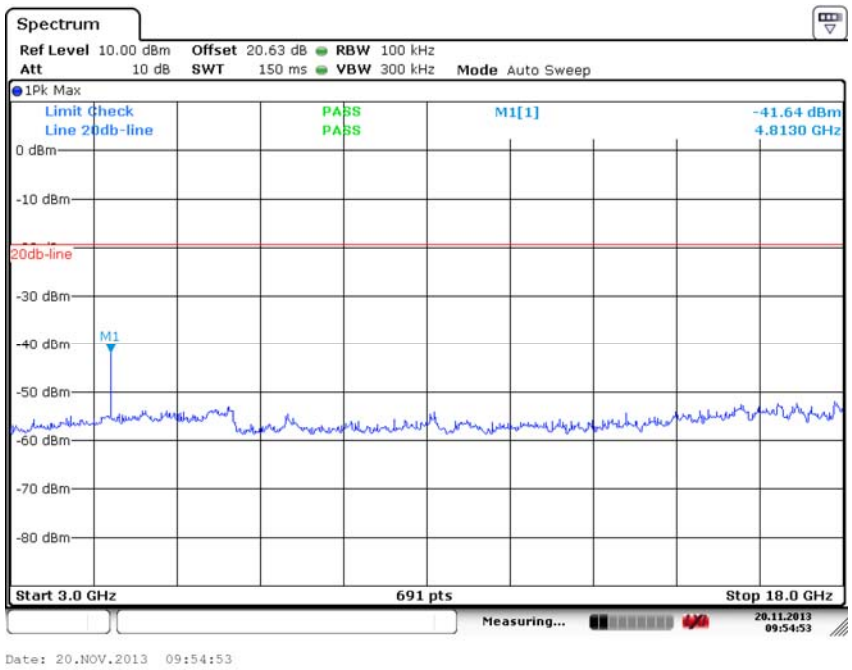

Fig. 14 Conducted Spurious Emission (Ch0, 3 GHz-18 GHz)

Fig. 15 Conducted Spurious Emission (Ch19, Center Frequency)

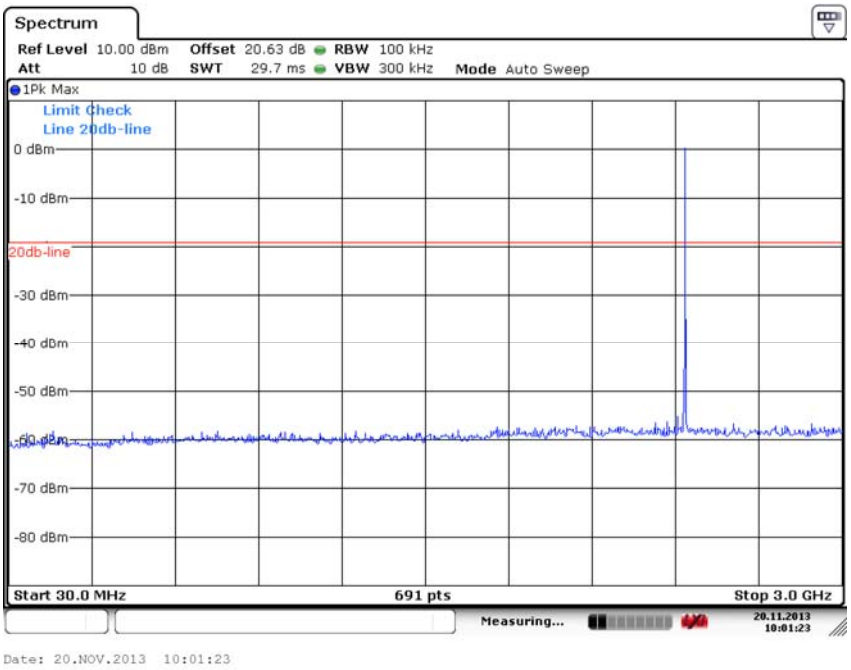

Fig. 16 Conducted Spurious Emission (Ch19, 30 MHz-3 GHz)

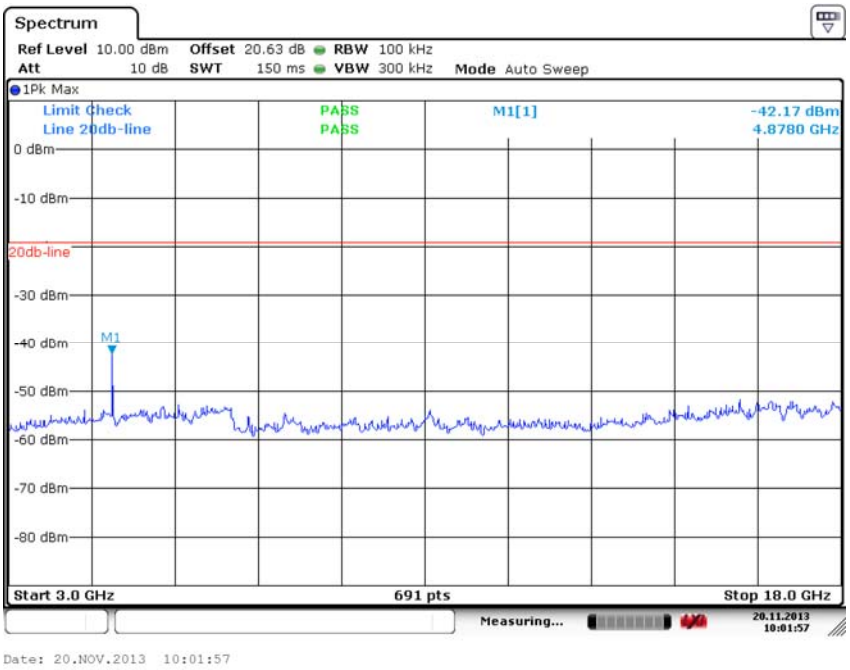

Fig. 17 Conducted Spurious Emission (Ch19, 3 GHz-18 GHz)

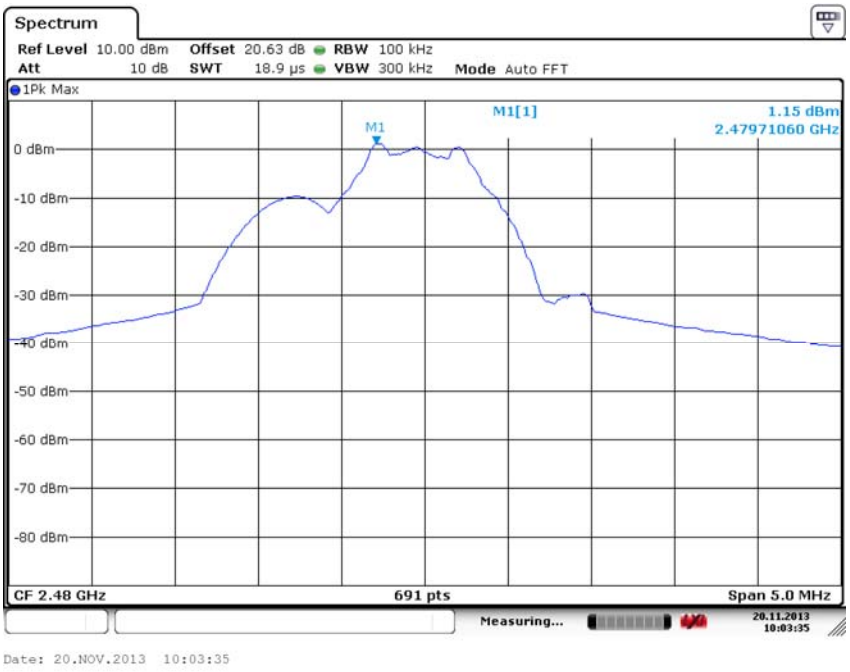

Fig. 18 Conducted Spurious Emission (Ch39, Center Frequency)

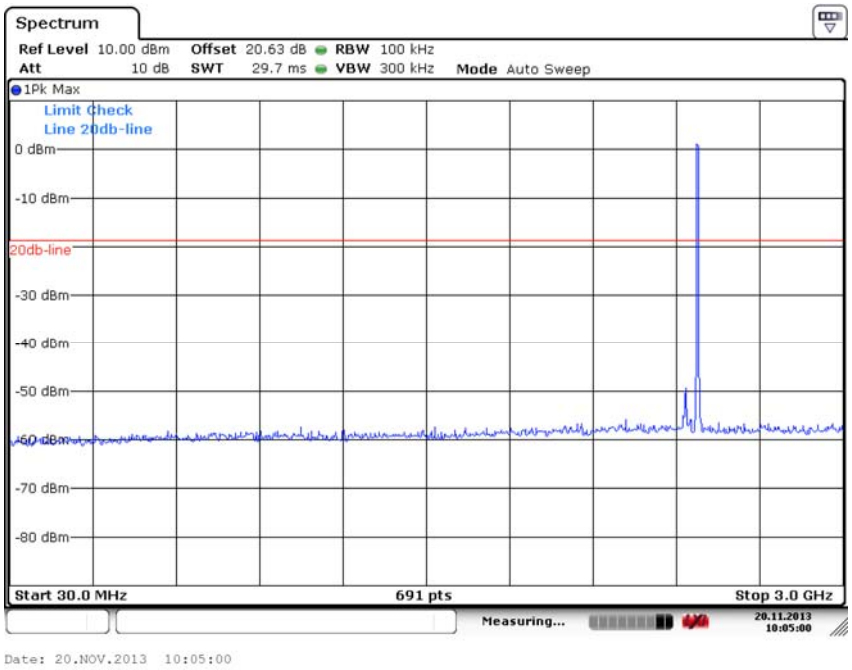

Fig. 19 Conducted Spurious Emission (Ch39, 30 MHz-3 GHz)

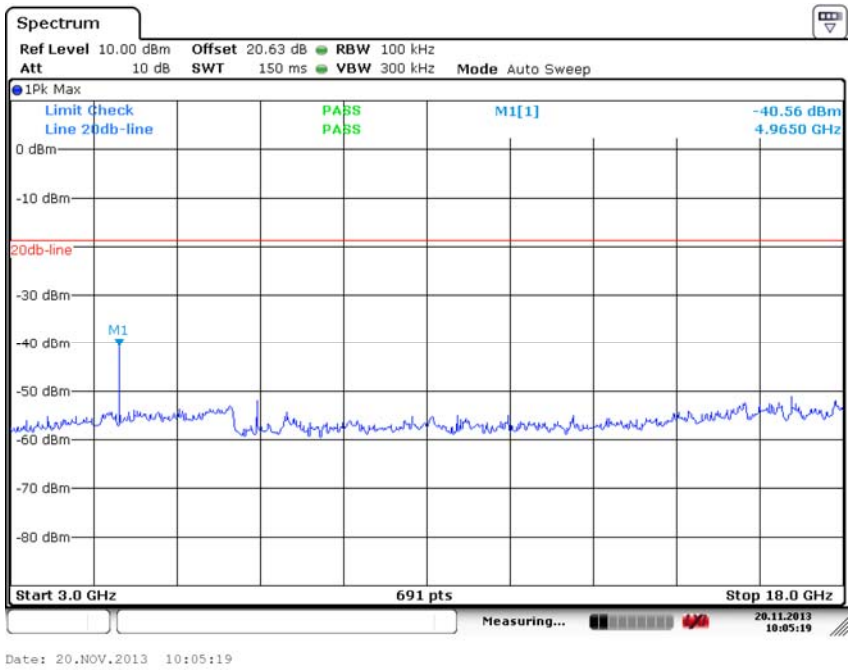

Fig. 20 Conducted Spurious Emission (Ch39, 3 GHz-18 GHz)

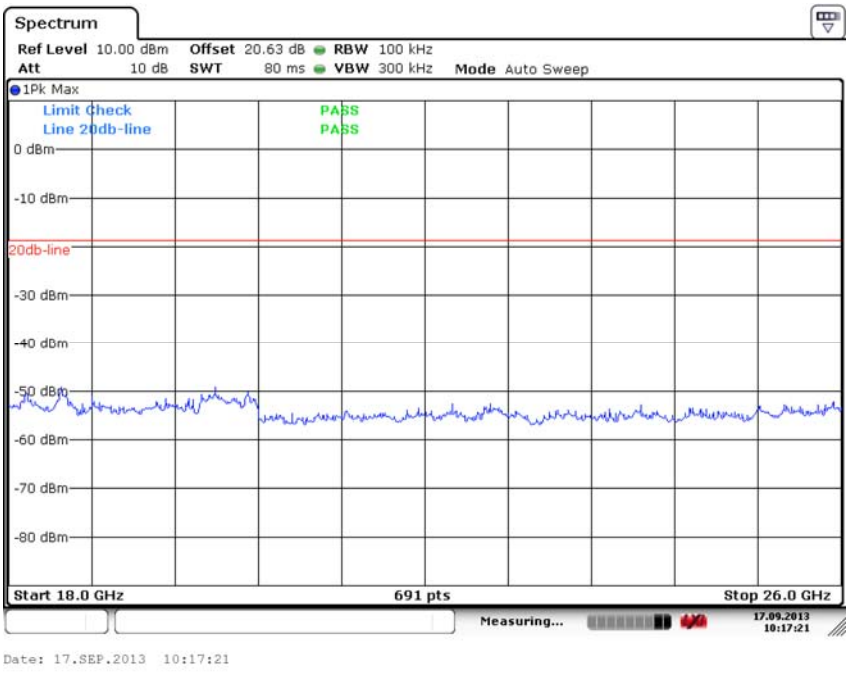

Fig. 21 Conducted Spurious Emission (All channels, 18 GHz-26 GHz)

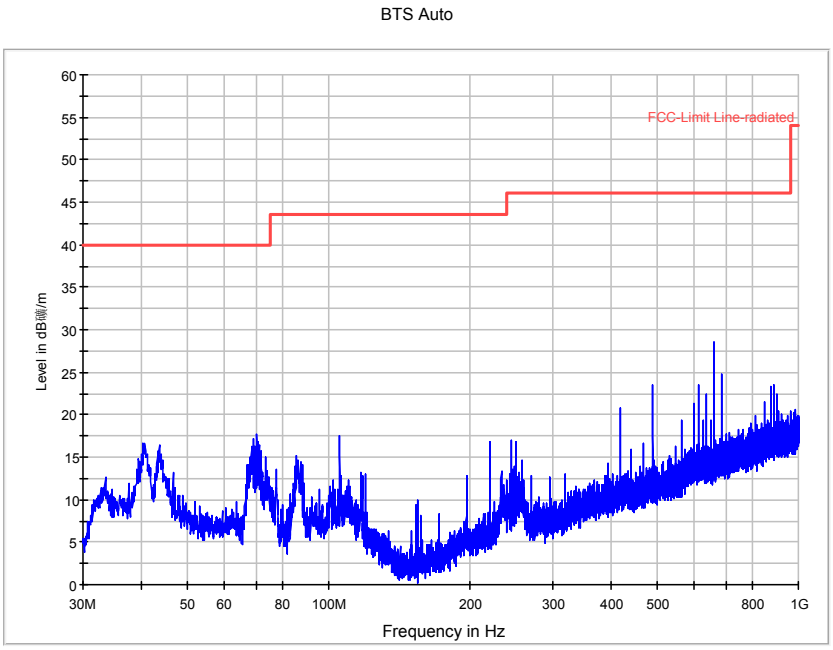

Fig. 22 Radiated Spurious Emission (Ch0, 30 MHz-1 GHz)

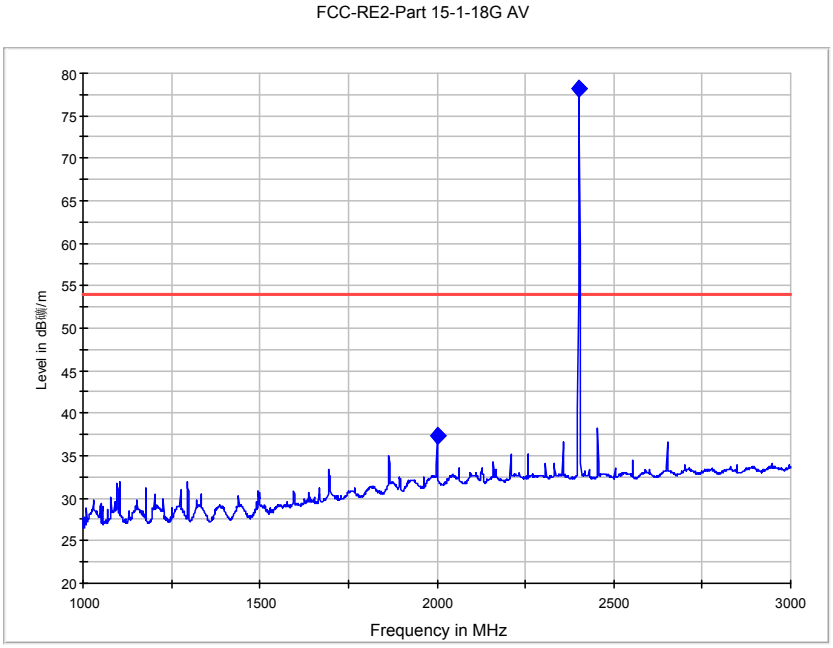

Fig. 23 Radiated Spurious Emission (Ch0, 1 GHz-3 GHz)

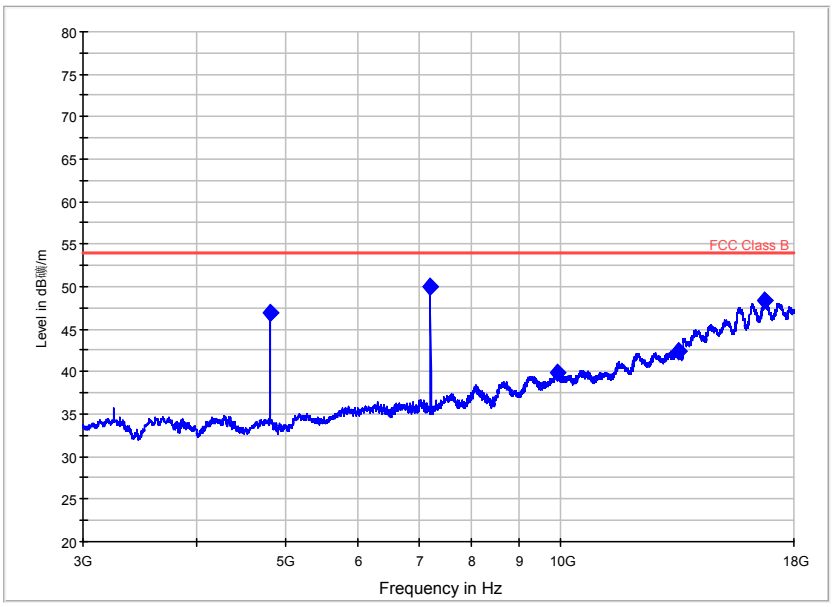

Fig. 24 Radiated Spurious Emission (Ch0, 3 GHz-18 GHz)

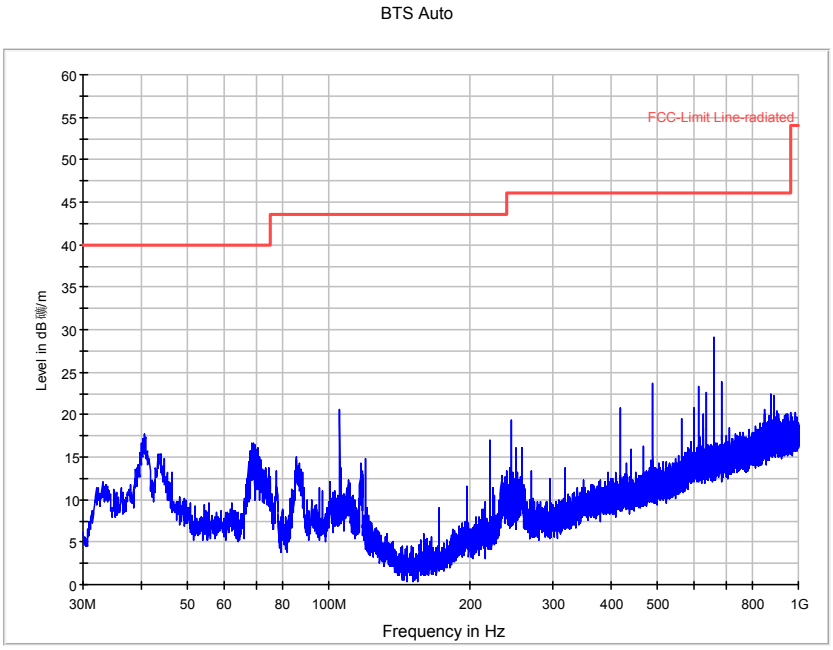

Fig. 25 Radiated Spurious Emission (Ch19, 30 MHz-1 GHz)

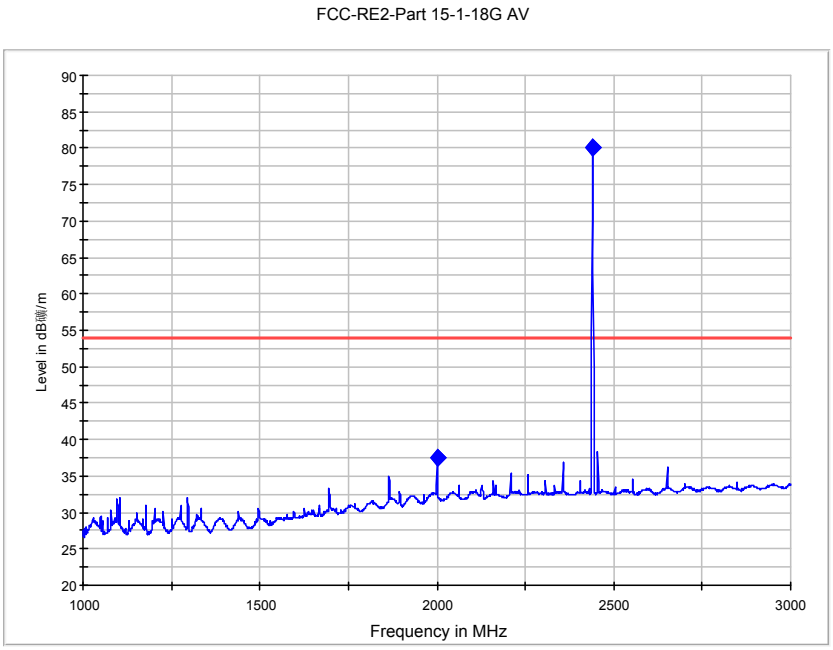

Fig. 26 Radiated Spurious Emission (Ch19, 1 GHz-3 GHz)

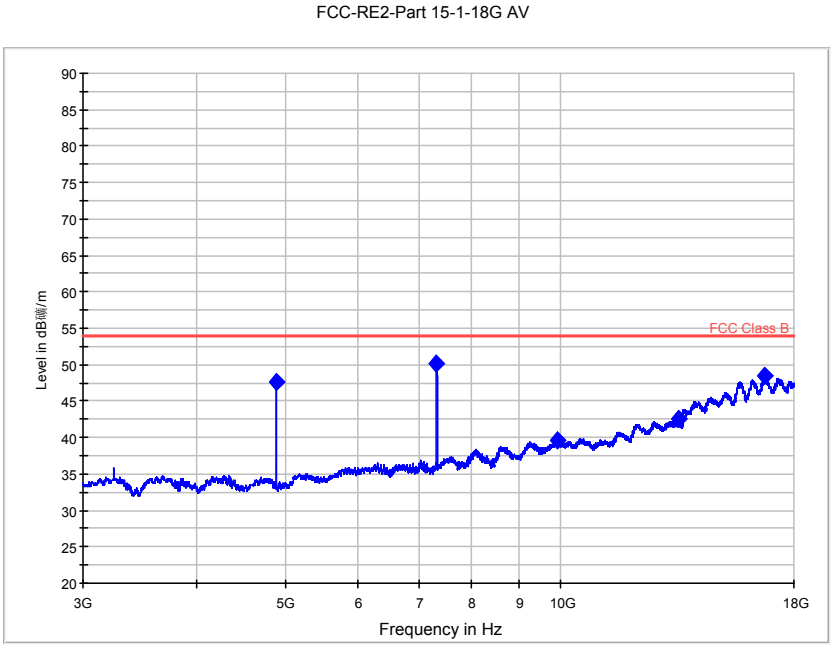

Fig. 27 Radiated Spurious Emission (Ch19, 3 GHz-18 GHz)

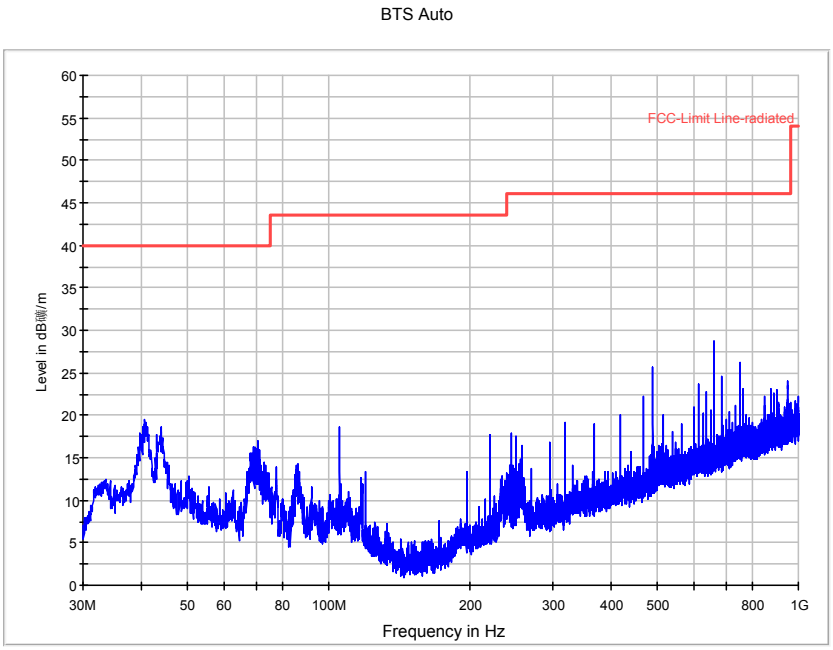

Fig. 28 Radiated Spurious Emission (Ch39, 30 MHz-1 GHz)

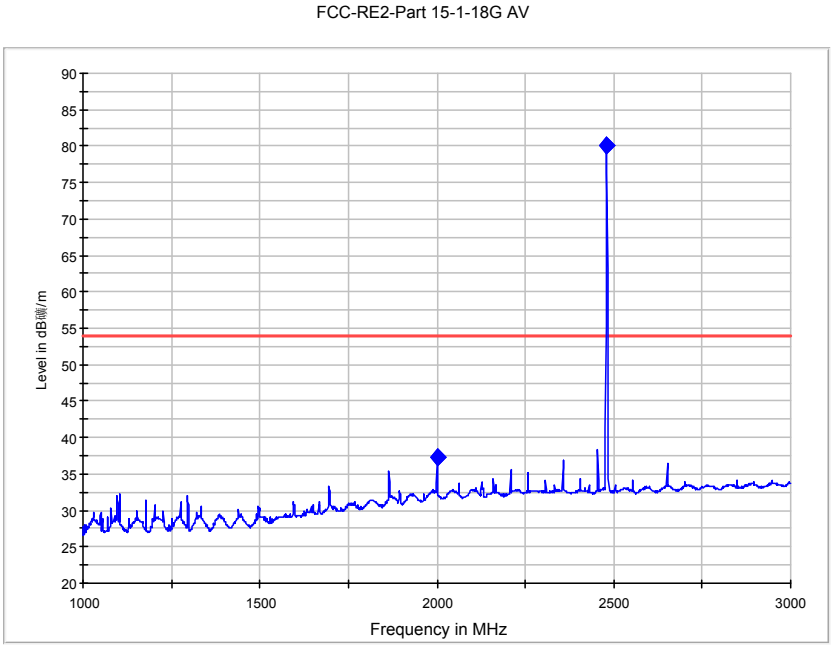

Fig. 29 Radiated Spurious Emission (Ch39, 1 GHz-3 GHz)

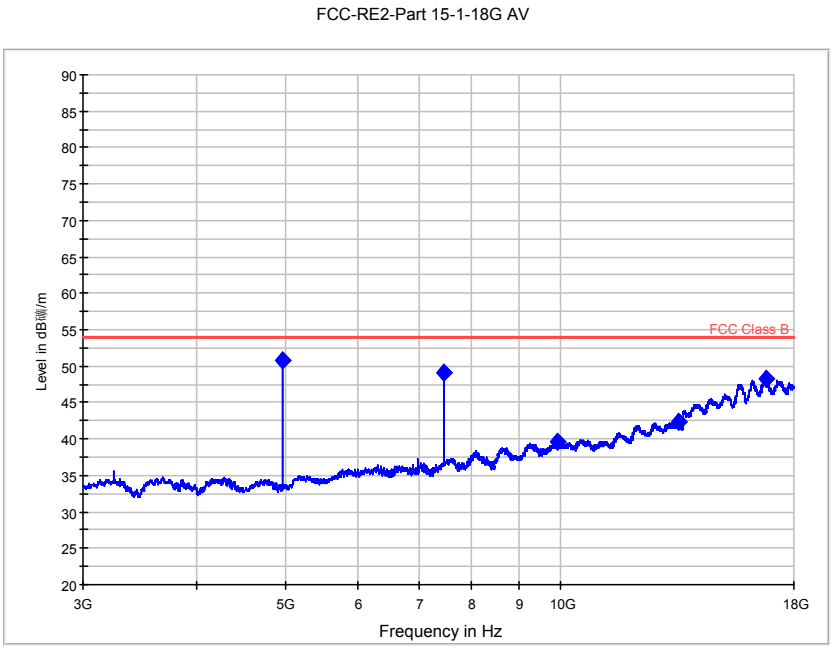

Fig. 30 Radiated Spurious Emission (Ch39, 3 GHz-18 GHz)

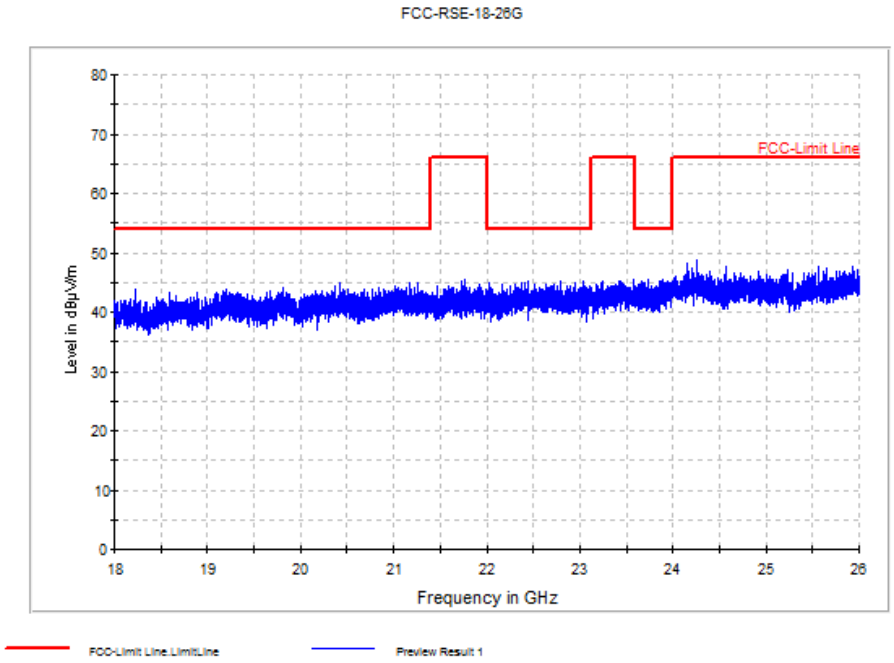

Fig. 31 Radiated emission: 18 GHz - 26 GHz

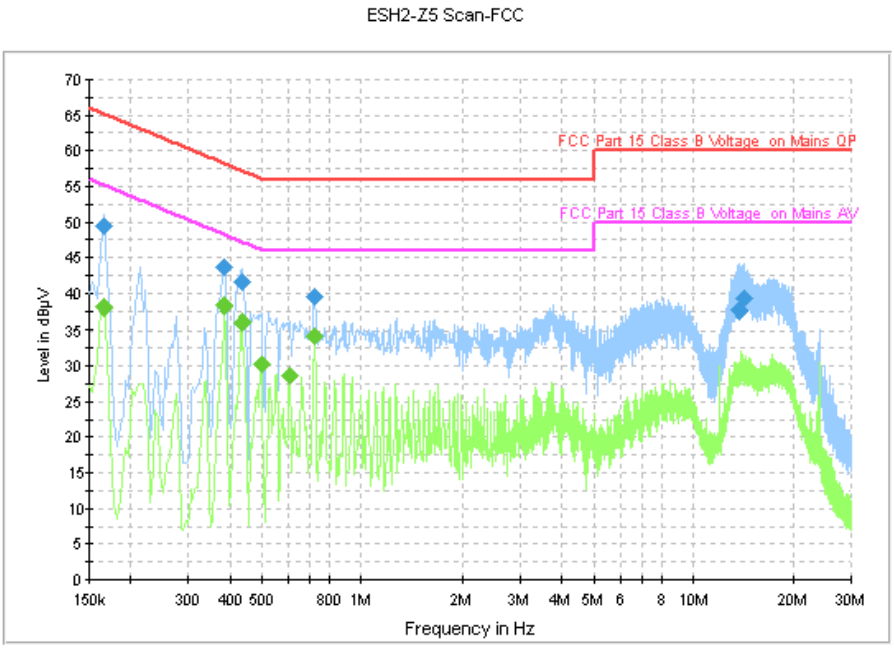

Fig. 32 AC Power line Conducted Emission (Traffic)

MEASUREMENT RESULT: " QuasiPeak "

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	49.4	FLO	L1	10.0	15.8	65.2
0.386000	43.7	FLO	L1	10.0	14.4	58.1
0.434000	41.6	FLO	L1	10.0	15.6	57.2
0.718000	39.5	FLO	L1	10.0	16.5	56.0
13.822000	37.6	FLO	L1	10.4	22.4	60.0
14.298000	39.4	FLO	L1	10.5	20.6	60.0

MEASUREMENT RESULT: " Average "

Frequency (MHz)	CAverage (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	38.2	FLO	L1	10.0	16.9	55.2
0.386000	38.3	FLO	L1	10.0	9.9	48.1
0.434000	36.1	FLO	L1	10.0	11.1	47.2
0.498000	30.3	FLO	L1	10.0	15.7	46.0
0.606000	28.7	FLO	L1	10.0	17.3	46.0
0.718000	34.3	FLO	L1	10.0	11.8	46.0

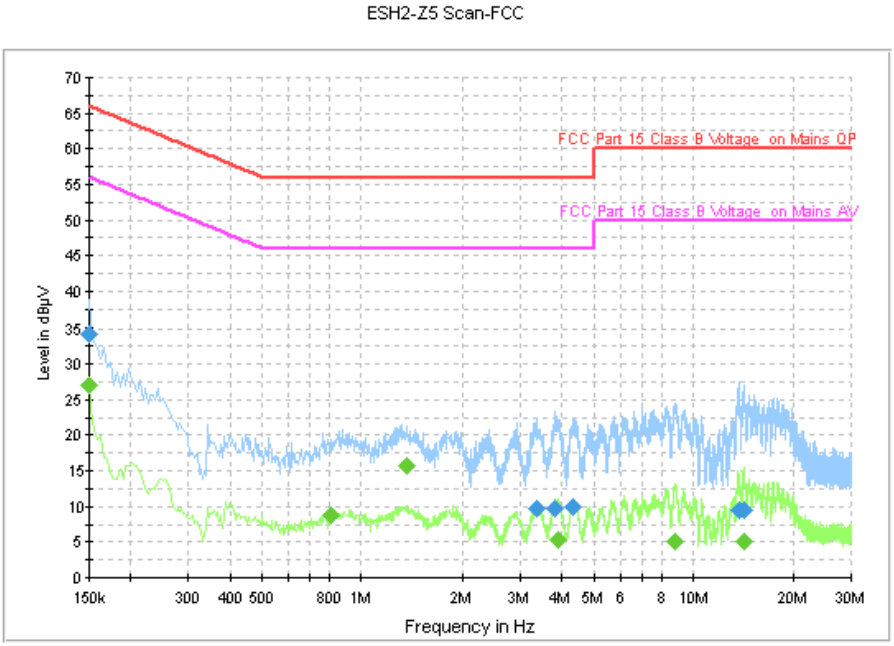

Fig. 33 AC Power line Conducted Emission (Idle)

MEASUREMENT RESULT: " QuasiPeak "

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	34.2	FLO	L1	10.0	31.8	66.0
3.338000	9.8	FLO	L1	10.2	46.2	56.0
3.826000	9.8	FLO	L1	10.2	46.2	56.0
4.306000	9.9	FLO	L1	10.2	46.1	56.0
13.718000	9.5	FLO	L1	10.4	50.5	60.0
14.186000	9.5	FLO	L1	10.5	50.5	60.0

MEASUREMENT RESULT: " Average "

Frequency (MHz)	CAverage (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	27.1	FLO	L1	10.0	28.9	56.0
0.806000	8.7	FLO	L1	10.1	37.3	46.0
1.370000	15.7	FLO	L1	10.1	30.3	46.0
3.882000	5.3	FLO	L1	10.2	40.7	46.0
8.790000	5.2	FLO	L1	10.3	44.8	50.0
14.178000	5.0	FLO	L1	10.5	45.0	50.0

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