AT4 wireless S.A.
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ENSAYOS Nº 51/LE203

TEST REPORT

REFERENCE STANDARD:

FCC Rules and Regulations 47 CFR Part 15, Subpart B

&

IC RSS-Gen Issue 2, June 2007

FCC Rules and Regulations 47 CFR Part 15, Subpart B: Limits and methods of measurements for radio frequency devices. Unintentional radiators

NIE ..... :	32032REM.001
Approved by (name / position & signature) ..... :	Rafael López EMC Manager
Elaboration date ..... :	2011-03-24

Rafael López Martín
Firmado digitalmente por Rafael López Martín
Fecha: 2011.03.28 09:27:16 +02'00'

Identification of item tested ..... :	WIRELESS MODULE 2.4 GHz
Trademark ..... :	Telit
Model and/or type reference ..... :	ZE51-2.4
Other identification of the product ..... :	**Commercial name:** **ZE51-2.4** **ZE51-2.4** **Model:** **ZE51-2.4** **ZE51-2.4** **HW Version:** **Rev C1** **Rev C1** **SW Version:** **1.02** **1.02** **Description:** **ZigBee RF Module with antenna connector on DIP support** **ZigBee RF Module with integrated module** **FCC ID:** **RI7ZE51** **RI7ZE51** **IC ID:** **5131A-ZE51** **5131A-ZE51**
Features ..... :	ZigBee module with external 5 dBi gain attachable antenna and integrated antenna
Description ..... :	ZigBee Module external antenna & ZigBee Module integrated antenna

Applicant ..... :	Telit Communications S.p.A
Address ..... :	Via Stazione di Prosecco, 5/B P.C.: 34010 Sgonico. (Trieste) Italy.
CIF/NIF/Passport ..... :	N/A
Contact person ..... :	Xavier Totapoulos
Telephone / Fax ..... :	+33.(0)4.97.21.33.18 / +33.(0)4.97.21.33.11
e-mail ..... :	xavier.tatopoulos@telit.com

Test samples supplier ..... :	Telit Communications S.p.A
Address ..... :	Via Stazione di Prosecco, 5/B P.C.: 34010 Sgonico. (Trieste) Italy.
CIF/NIF/Passport..... :	N/A
Contact person: ..... :	Xavier Totapoulos
Telephone / Fax ..... :	+33.(0)4.97.21.33.18 / +33.(0)4.97.21.33.11
e-mail: ..... :	xavier.tatopoulos@telit.com
Manufacturer ..... :	TELIT RF TECHNOLOGIES SAS
Address ..... :	Rue Evariste Galois Emerald square – Bâtiment D, Sophia-Antipolis. France.
CIF/NIF/Passport..... :	FR 55451625289
Contact person: ..... :	Xavier Tatopoulos
Telephone / Fax ..... :	+33.(0)4.97.21.33.18 / +33.(0)4.97.21.33.11
e-mail: ..... :	xavier.tatopoulos@telit.com
Test method requested ..... :	
Standard..... :	FCC Rules and Regulations 47 CFR Part 15 & IC RSS-Gen Issue 2, June 2007
Test procedure.....:	PEEM001; PEEM002
Report template No. ..... :	FDT08_12

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Competences and guarantees

This certificate of conformity was issued in accordance with the decision Nº 3/2000 of the Joint Committee established under the Agreement on Mutual Recognition between the European Community and the United States of America. By this decision, AT4 wireless can act as Conformity Assessment Body (CAB) on Electromagnetic Compatibility. This Certificate applies to the samples listed at technical reports.

This laboratory is designed by the Federal Communications Commission (ES0004)

AT4 wireless is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the following AT4 wireless's internal documents:

1. PODT000: Procedure for the measure uncertainty calculation.

Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
32032D/03	ZigBee RF module with antenna connector on DIP support	ZE51-2.4	Commercial name: ZE51-2.4 Model: ZE51-2.4 HW Version: Rev C1 SW Version: 1.02 FCC ID: RI7ZE51 IC ID: 5131A-ZE51	2010-12-08
32032D/08	5 dBi Dipole Antenna	TAOGLAS / 5dBi	---	2010-12-08

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
32032D/01	ZigBee RF module with integrated antenna on DIP support	ZE51-2.4	Commercial name: ZE51-2.4 Model: ZE51-2.4 HW Version: Rev C1 SW Version: 1.02 FCC ID: RI7ZE51 IC ID: 5131A-ZE51	2010-12-08

Auxiliary elements used with the samples S/01 & S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
32032D/06	Test Board	905.001.549	B5GJ00153+	2010-12-08
32032D/12	AC/DC Adapter	FBC12050	---	2010-12-08

* The module ZE51 can also work with a 2dBi antenna.

Samples S/01 & S/02 has undergone the next test(s):

1. Continuous conducted emission, power leads:
   - Standard: FCC Rules and Regulations 47 CFR Part 15& IC RSS-Gen Issue 2, June 2007
   - Method: FCC Rules and Regulations 47 CFR Part 15, Subpart B (Class B) & IC RSS-Gen Issue 2, June 2007
2. Radiated emission, electromagnetic field:
   - Standard: FCC Rules and Regulations 47 CFR Part 15& IC RSS-Gen Issue 2, June 2007
   - Method: FCC Rules and Regulations 47 CFR Part 15, Subpart B (Class B) & IC RSS-Gen Issue 2, June 2007

Testing period

The performed test started on 2010-12-03 and finished on 2011-02-23.

The tests have been performed at AT4 wireless.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 80 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters), the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 30 ºC
Relative humidity	Min. = 45 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 30 ºC
Relative humidity	Min. = 45 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

Summary

Considering the results of the performed test according to standard **FCC Rules and Regulations 47 CFR Part 15 & IC RSS-Gen Issue 2**, **June 2007,** the items under test are **IN COMPLIANCE** with the requested specifications specified in the standard.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

Remarks and comments

The tests have been realized by the technical personnel: José Carlos Luque, Margarita Haro & José Manuel Marquez.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 150 kHz to 30 MHz is I = ± 3,60 dB for quasi-peak measurements, I = ± 3,48 dB for peak measurements (k = 2).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1 GHz is I = ± 4,57 dB for quasi-peak measurements, I = ± 4,48 dB for peak measurements (k = 2) and from 1 to 12,75 GHz is I = ± 3,43 dB for average and peak measurements.

Testing verdicts

Not applicable .....: NA

Pass.....: P

Fail .....: F

Not measured.....: NM

List of equipment used during the test

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
1999	EMI Receptor	ROHDE & SCHWARZ	ESIB 26	2009-09-04	2011-09-04
2942	EMI Receptor	ROHDE & SCHWARZ	ESU 40	2009-11-23	2011-11-23
245	Horn Antenna	HEWLETT PACKARD	11966E	2008-03-18	2011-03-18
246	Horn Antenna	HEWLETT PACKARD	11966E	2009-02-23	2012-02-23
1658	RF Amplifier	SCHAFFNER	CPA9231A	2009-03-31	2011-03-31
3541	Bilog Hybrid antenna	SUNOL SCIENCES CORPORATION	JB6	2009-06-03	2012-06-03

APPENDIX A

Test Result

APPENDIX A CONTENT:

DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

In the following table appears the operation modes used by the samples tested to that it refers the present test report.

OPERATION MODE	DESCRIPTION
OM#01	EUT ON. IDLE mode. Power supply: 230Vac (In interface board the module is powered for 3Vdc.).
OM#02	EUT ON. TCH mode. Modulated carrier transmission. Power supply: 230Vac (In interface board the module is powered for 3Vdc.).

RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE.

LIMITS:	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B & IC RSS-Gen Issue 2, June 2007
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B & IC RSS-Gen Issue 2, June 2007

LIMITS OF INTERFERENCE CLASS B

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B in the frequency range 30 MHz to 12,5 GHz, for Class B equipment, which is a transmitter in a band over 500 MHz, was:

Frequency range (MHz)	**Limit for 3 m (µV/m)**	**Limit for 3 m (dBµV/m)**
30 to 88	100	40
88 to 216	150	43,52
216 to 960	200	46,02
Above 960	500	53,98

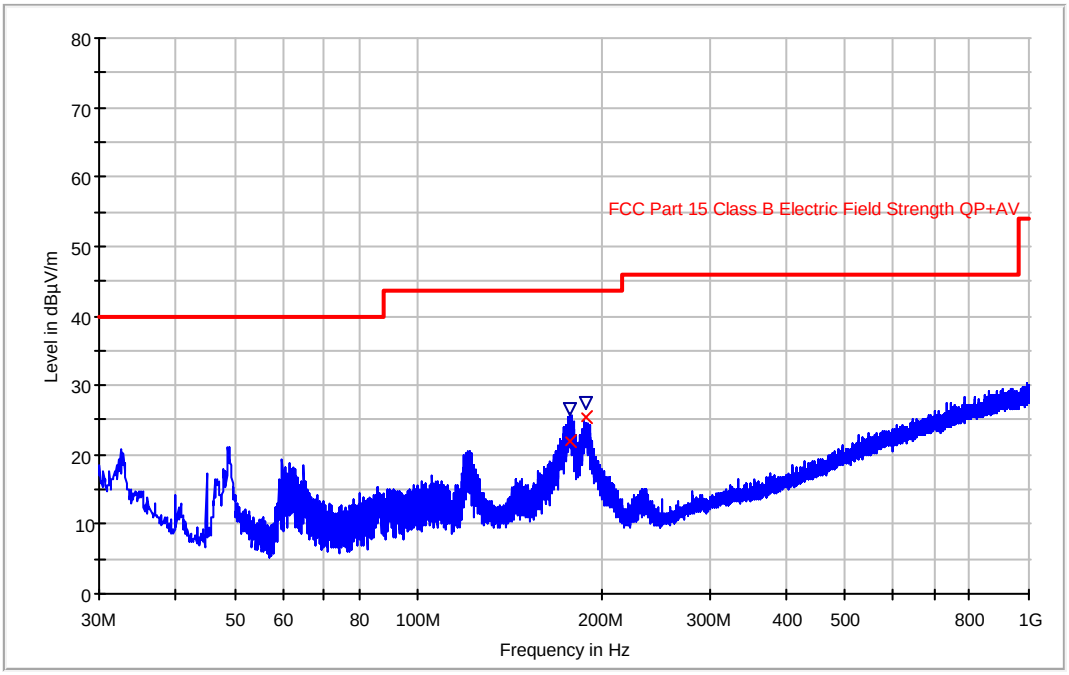
TESTED SAMPLES:	S/01 & 02
TESTED OPERATION MODES:	OM#01
TEST RESULTS :	**CR**mmnn: CR, Radiation Condition; mm: Sample number; nn: Operation mode, xx: Polarization.

CRmmnn	**Description**	**Result**
CR0101	EUT ON. IDLE mode. Range 30 - 1000 MHz.	P
CR0101PH	EUT ON. IDLE mode MHz. Range 1 – 12.5 GHz. Horizontal polarization	P
CR0101PV	EUT ON. IDLE mode. Range 1 – 12.5 GHz. Vertical polarization	P
CR0201	EUT ON. IDLE mode. Range 30 - 1000 MHz.	P
CR0201PH	EUT ON. IDLE mode MHz. Range 1 – 12.5 GHz. Horizontal polarization	P
CR0201PV	EUT ON. IDLE mode. Range 1 – 12.5 GHz. Vertical polarization	P

Radiated Emission: CR0101 (30MHz to 1GHz)

Project:	32032REM.001
Company:	TELIT
Sample:	S/01
Operation Mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode.

FCC class B Bilog Hybrid



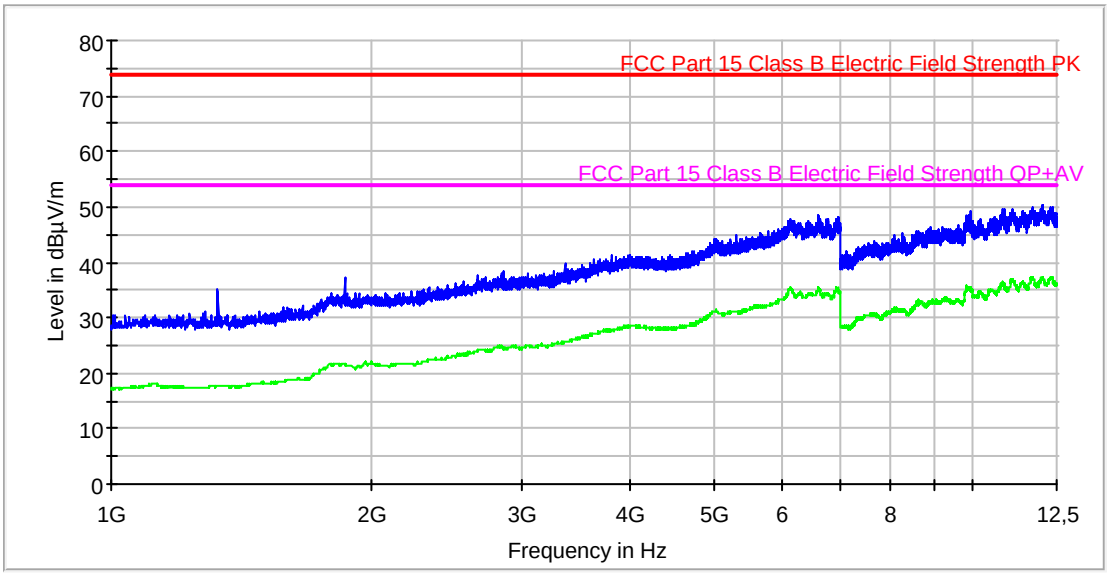
Maximized

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
177.257315	22.0	26.5	158.00	H	289.0
187.661523	25.5	27.5	177.00	H	290.0

Radiated Emission: CR0101 (1GHz to 12.5GHz Horizontal polarization)

Project:	32032REM.001
Company:	TELIT
Sample:	S/01
Operation Mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode. Horizontal polarization.

FCC 1-12.5GHz class B



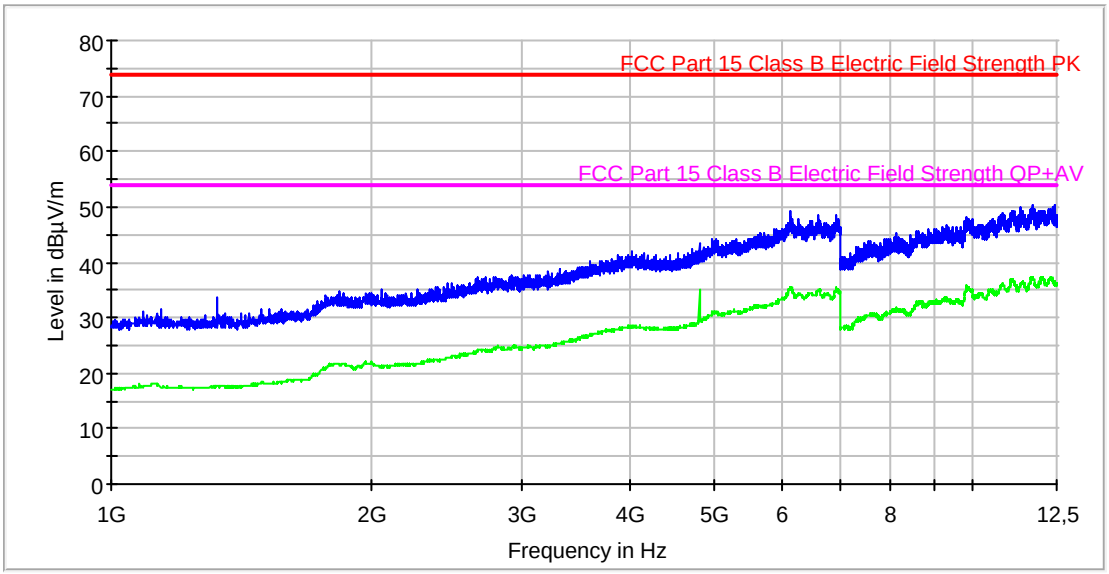
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
1285.000000	31.0	17.4
1331.000000	35.3	17.7
1866.000000	37.4	21.7
2668.000000	37.6	24.3
3361.000000	40.0	25.6
4460.000000	41.4	28.2
5789.000000	45.7	32.2
6626.000000	48.6	35.3
9635.000000	46.7	32.8
12068.000000	50.4	37.1

Radiated Emission: CR0101 (1GHz to 12.5GHz Vertical polarization)

Project:	32032REM.001
Company:	TELIT
Sample:	S/01
Operation Mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode. Vertical polarization.

FCC 1-12.5GHz class B



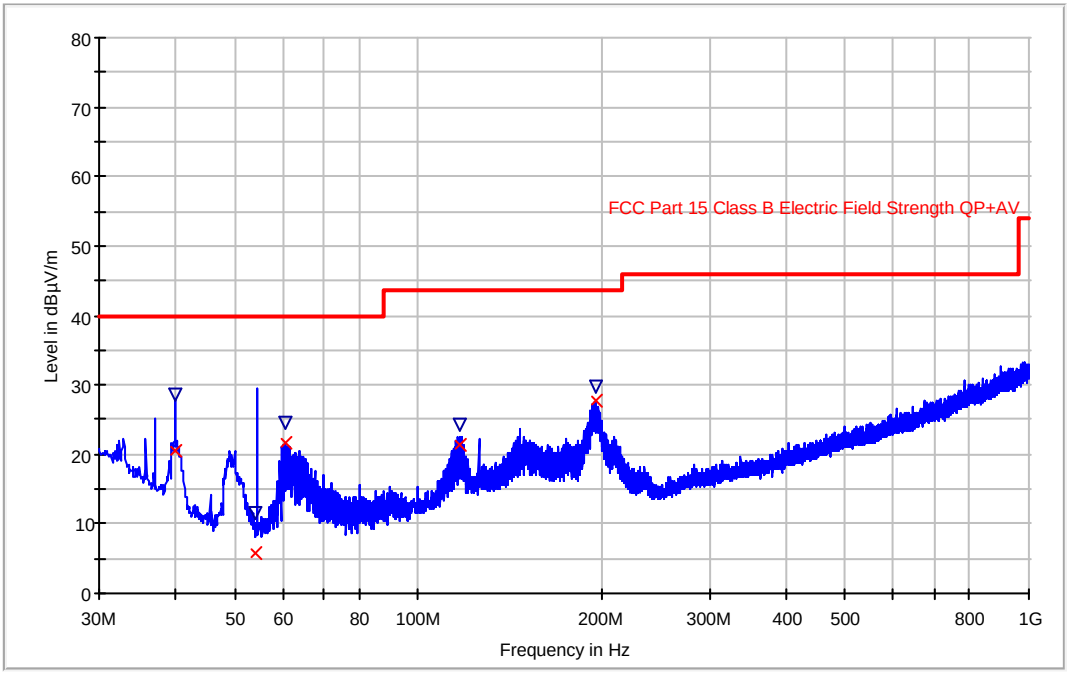
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Average-ClearWrite (dBµV/m)
1145.000000	31.4	17.3
1326.000000	33.7	17.6
2061.000000	34.9	21.2
2726.000000	37.1	24.0
3509.000000	39.3	26.3
4025.000000	42.1	28.5
5677.000000	45.4	32.0
6133.000000	49.3	35.3
9304.000000	46.6	33.4
11695.000000	50.2	37.2

Radiated Emission: CR0201 (30MHz to 1GHz)

Project:	32032REM.001
Company:	TELIT
Sample:	S/02
Operation mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode.

FCC class B Bilog Hybrid AMP2193



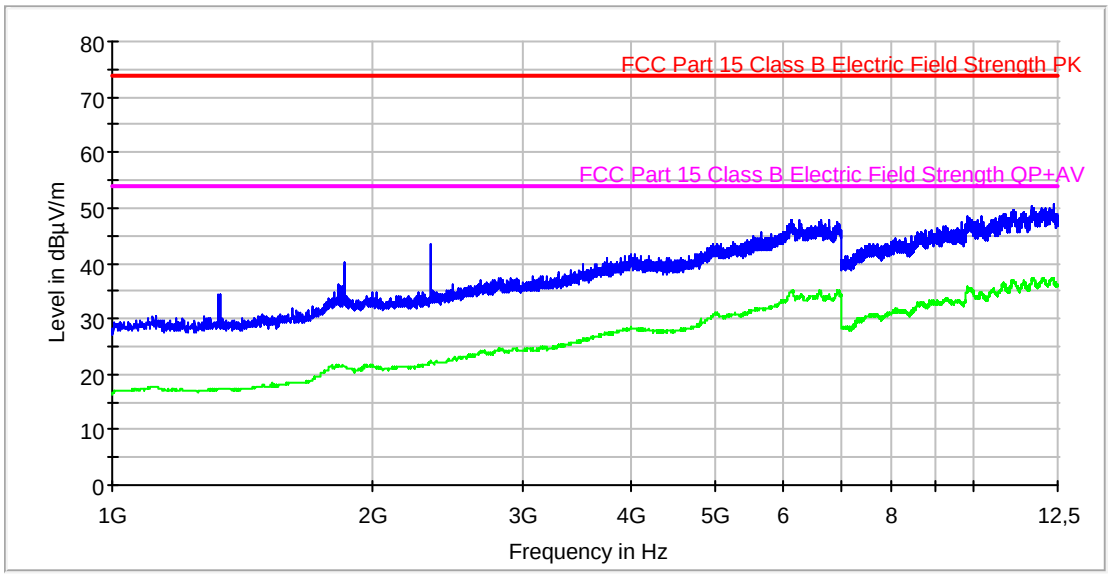
Maximized

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg)
39.972946	20.4	28.6	98.00	V	356.0
54.240681	5.7	11.6	275.00	H	52.0
60.705010	21.6	24.4	109.00	V	292.0
116.624449	21.3	24.4	137.00	V	356.0
195.623447	27.7	29.7	182.00	H	297.0

Radiated Emission: CR0201 (1GHz to 12.5GHz Horizontal polarization)

Project:	32032REM.001
Company:	TELIT
Sample:	S/02
Operation Mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode. Horizontal polarization.

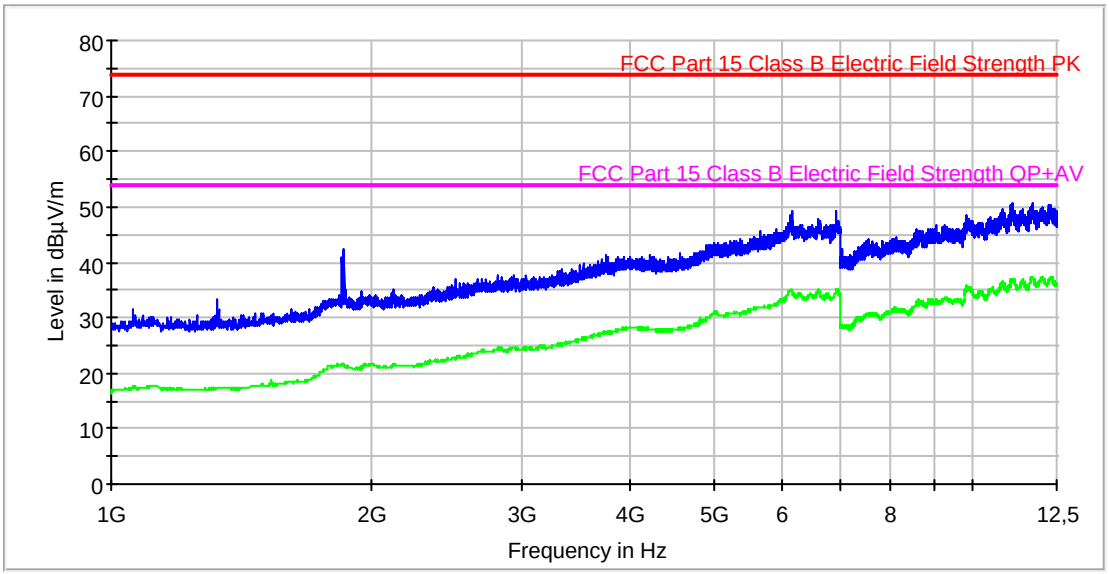
FCC 1-12.5GHz class B



Radiated Emission: CR0201 (1GHz to 12.5GHz Vertical polarization)

Project:	32032REM.001
Company:	TELIT
Sample:	S/02
Operation Mode:	OM#01
Setup:	EMI radiated
Mode:	EUT ON. Idle mode. Vertical polarization.

FCC 1-12.5GHz class B



CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

LIMITS:	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B & IC RSS-GEN ISSUE 2, JUNE 2007
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B & IC RSS-GEN ISSUE 2, JUNE 2007

CLASS B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B & IC RSS-Gen Issue 2, June 2007 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	**Limit (dBµV)**	
	Quasi-peak	**Average**
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

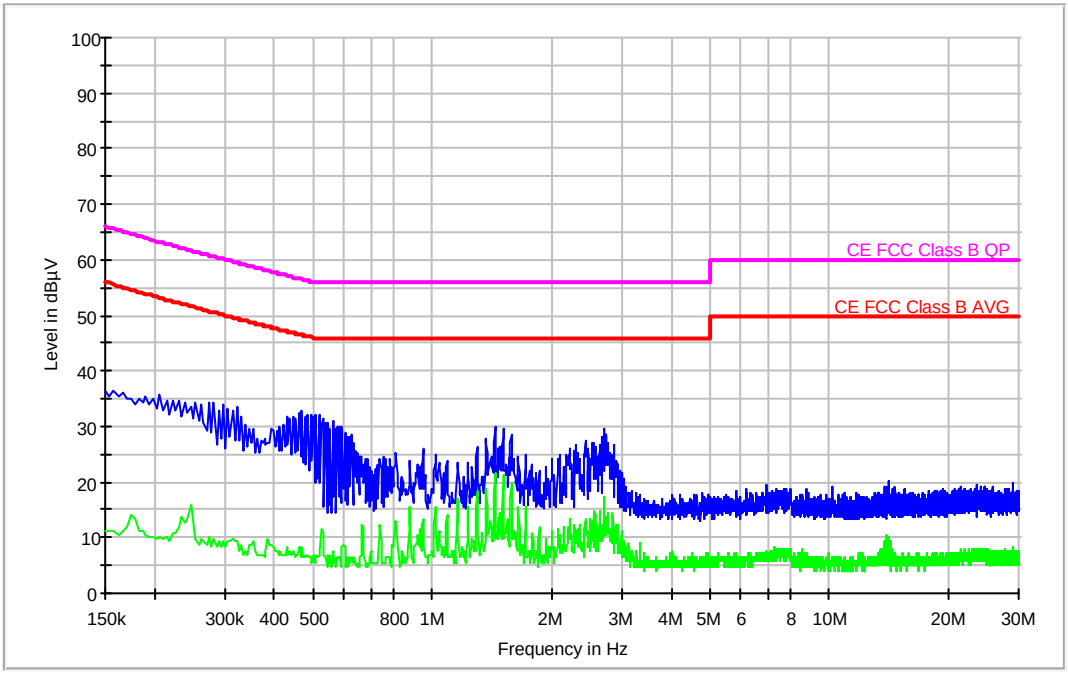
TESTED SAMPLES:	S/01 & 02
TESTED OPERATION MODES:	OM#01 & 02
TEST RESULTS :	CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire

CCmmnnhh	**Description**	**Result**
CC01010N	Neutral wire noise	P
CC0101L1	Phase wire noise	P
CC01020N	Neutral wire noise	P
CC0102L1	Phase wire noise	P
CC02010N	Neutral wire noise	P
CC0201L1	Phase wire noise	P
CC02020N	Neutral wire noise	P
CC0202L1	Phase wire noise	P

Continuous Conducted emission : CC01010N	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/01
Operation mode: OM#01
Setup: EMI conducted
Mode: EUT ON. Idle mode. Neutral noise.

EC FCC Class B ESIB26 ALC



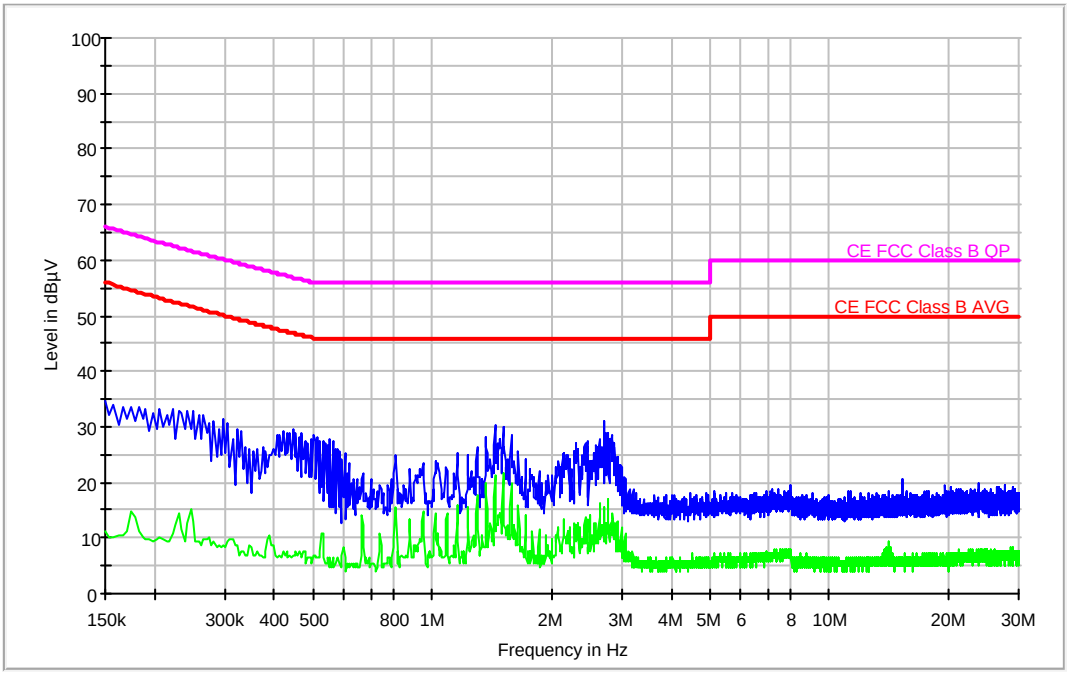
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.150000	36.5	11.0
0.282000	34.4	9.8
0.470000	32.8	8.3
0.594000	29.9	8.3
1.298000	26.2	18.4
1.438000	29.8	21.8
2.714000	29.4	12.4
4.810000	18.1	5.6
6.938000	19.3	7.1
10.218000	19.0	6.5
14.114000	20.1	9.6
28.886000	19.9	7.5

Continuous Conducted emission : CC0101L1	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/01
Operation mode: OM#01
Setup: EMI conducted
Mode: EUT ON. Idle mode. Phase noise.

EC FCC Class B ESIB26 ALC



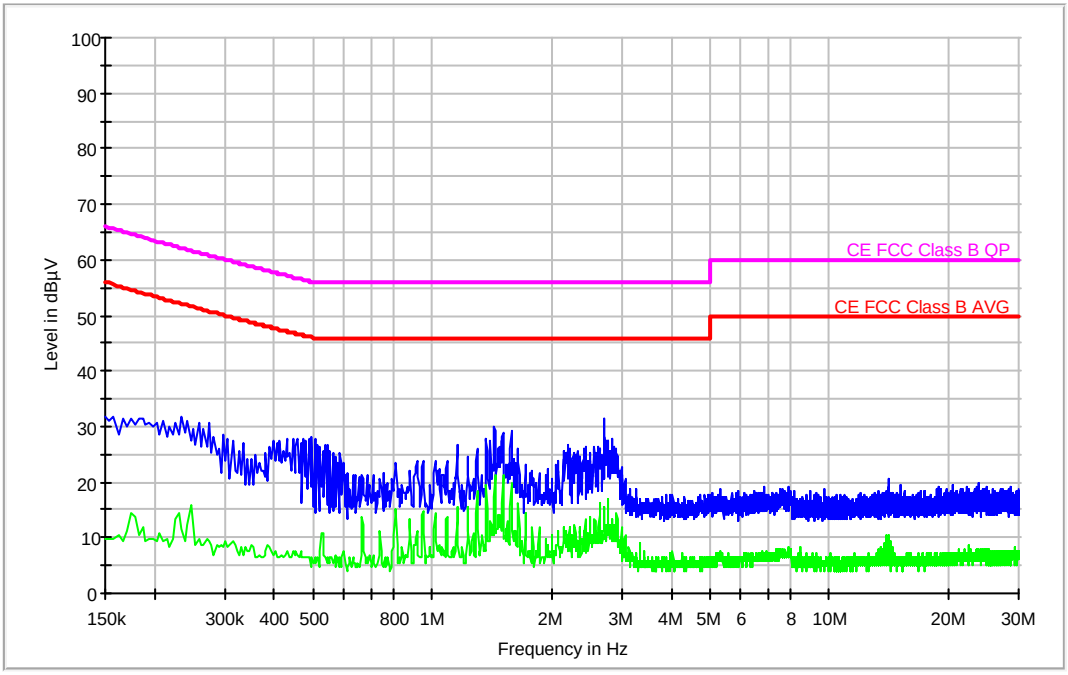
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.150000	34.7	11.0
0.250000	32.8	13.0
0.446000	29.6	7.0
0.578000	26.0	6.3
1.298000	26.3	17.6
1.438000	30.2	21.1
2.710000	30.9	15.4
4.902000	18.1	6.4
7.450000	18.8	6.4
8.010000	19.5	6.4
15.314000	20.5	6.5
23.866000	19.9	6.7

Continuous Conducted emission : CC01020N	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/01
Operation mode: OM#02
Setup: EMI conducted
Mode: EUT ON. TCH mode. Modulated carrier transmission. Neutral noise.

EC FCC Class B ESIB26 ALC



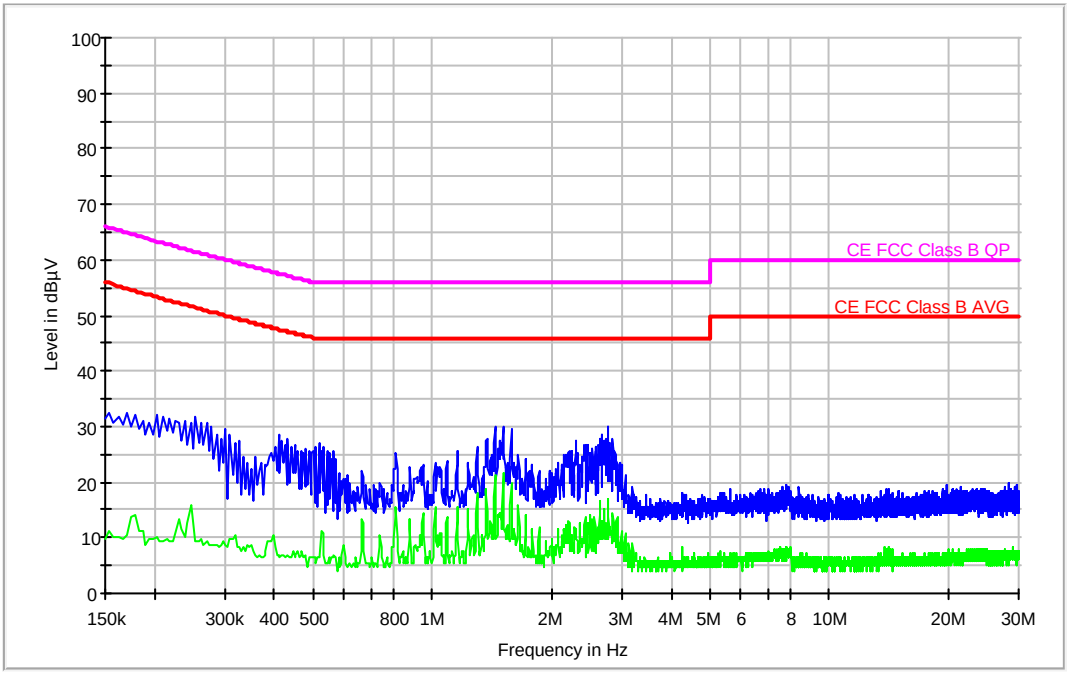
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.158000	31.7	9.7
0.234000	31.9	11.5
0.498000	28.0	6.3
0.586000	25.2	6.3
1.158000	26.8	15.6
1.434000	29.8	17.2
2.710000	31.4	15.1
5.062000	18.1	6.4
6.894000	19.2	7.1
9.678000	18.7	5.7
14.034000	20.6	10.5
23.818000	19.9	7.4

Continuous Conducted emission : CC0102L1	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/01
Operation mode: OM#02
Setup: EMI conducted
Mode: EUT ON. TCH mode. Modulated carrier transmission. Phase noise.

EC FCC Class B ESIB26 ALC



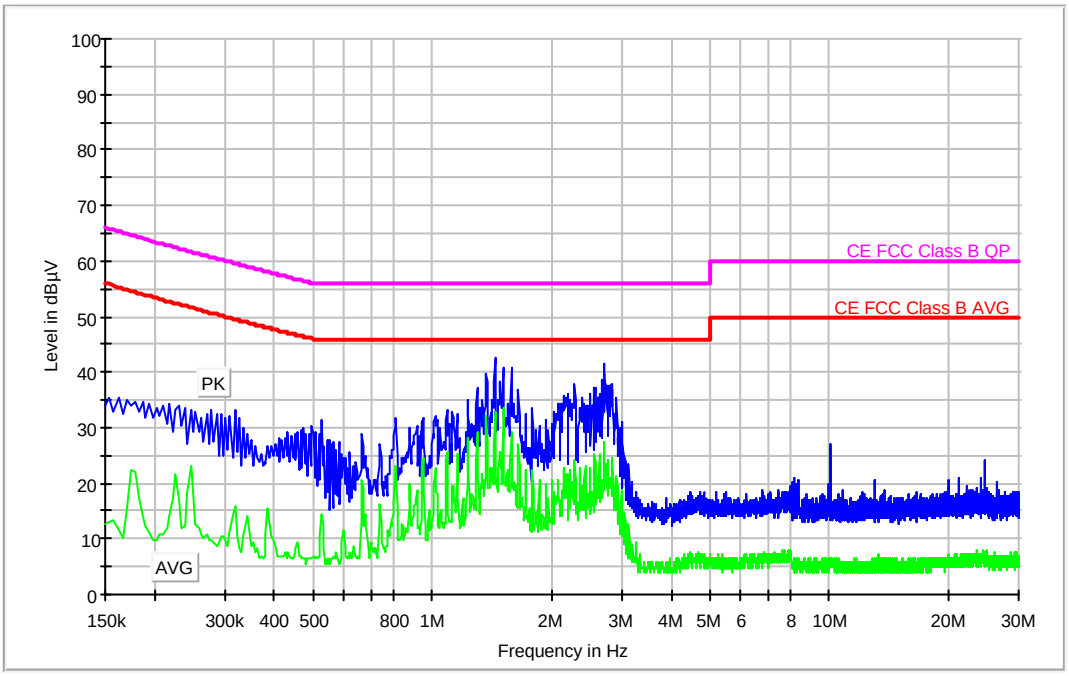
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.170000	32.4	10.6
0.254000	31.8	9.3
0.410000	28.7	7.0
0.566000	25.6	7.0
1.298000	26.5	18.0
1.510000	30.0	21.5
2.778000	29.8	17.0
4.242000	18.0	8.3
7.770000	19.7	7.1
8.402000	19.0	6.4
14.134000	18.9	5.8
28.386000	20.0	7.5

Continuous Conducted emission : CC02010N	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/02
Operation mode: OM#01
Setup: EMI conducted
Mode: EUT ON. Idle mode. Neutral noise.

EC FCC Class B ESIB26 ALC



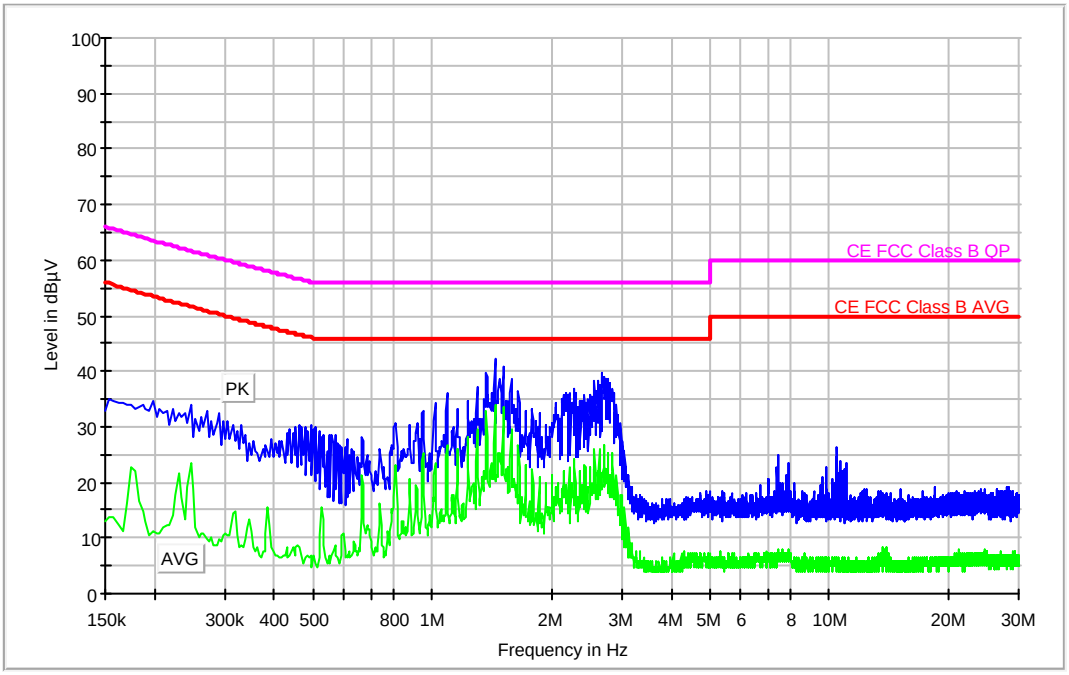
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.162000	35.4	11.4
0.238000	33.6	12.3
0.526000	31.5	14.6
0.810000	31.8	23.1
1.298000	37.4	29.2
1.438000	42.6	33.0
2.706000	41.6	27.5
4.486000	18.4	6.4
7.438000	18.8	6.4
10.070000	27.0	6.5
13.022000	20.5	5.8
24.630000	24.2	7.4

Continuous Conducted emission : CC0201L1	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/02
Operation mode: OM#01
Setup: EMI conducted
Mode: EUT ON. Idle mode. Phase noise.

EC FCC Class B ESIB26 ALC



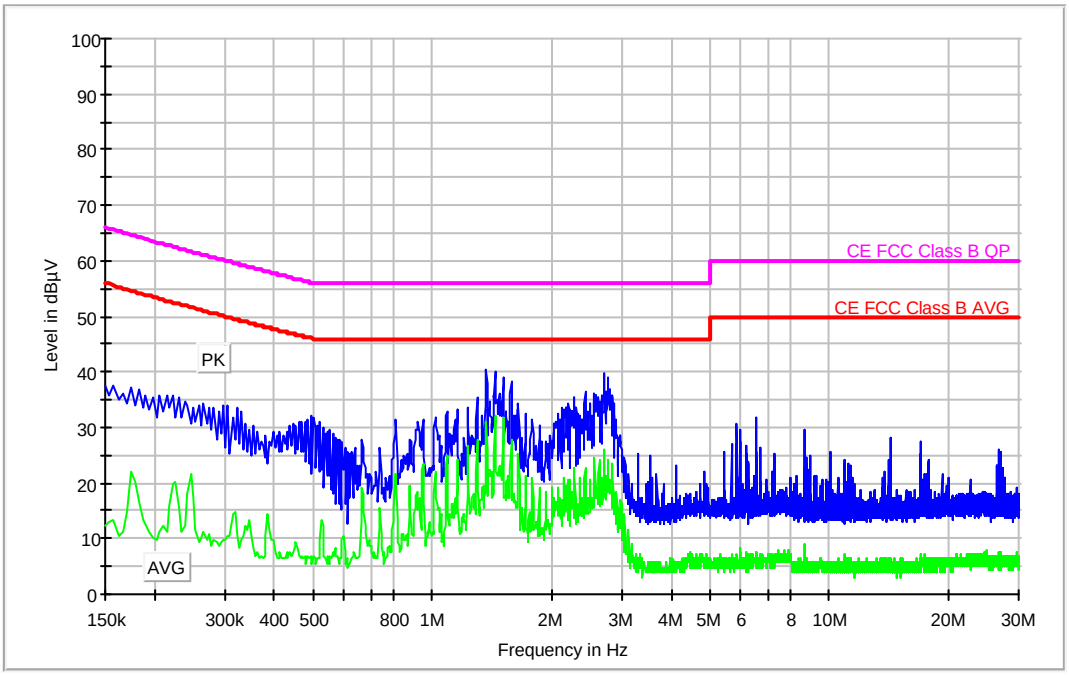
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.154000	35.2	13.8
0.246000	33.9	23.4
0.494000	30.4	7.0
0.810000	30.8	23.1
1.298000	37.2	29.5
1.438000	42.2	33.8
2.682000	39.8	20.9
4.986000	18.4	7.1
7.442000	25.0	7.8
10.482000	26.3	6.5
18.462000	19.0	5.8
28.466000	19.2	6.8

Continuous Conducted emission : CC02020N	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/02
Operation mode: OM#02
Setup: EMI conducted
Mode: EUT ON. TCH mode. Modulated carrier transmission. Neutral noise.

EC FCC Class B ESIB26 ALC



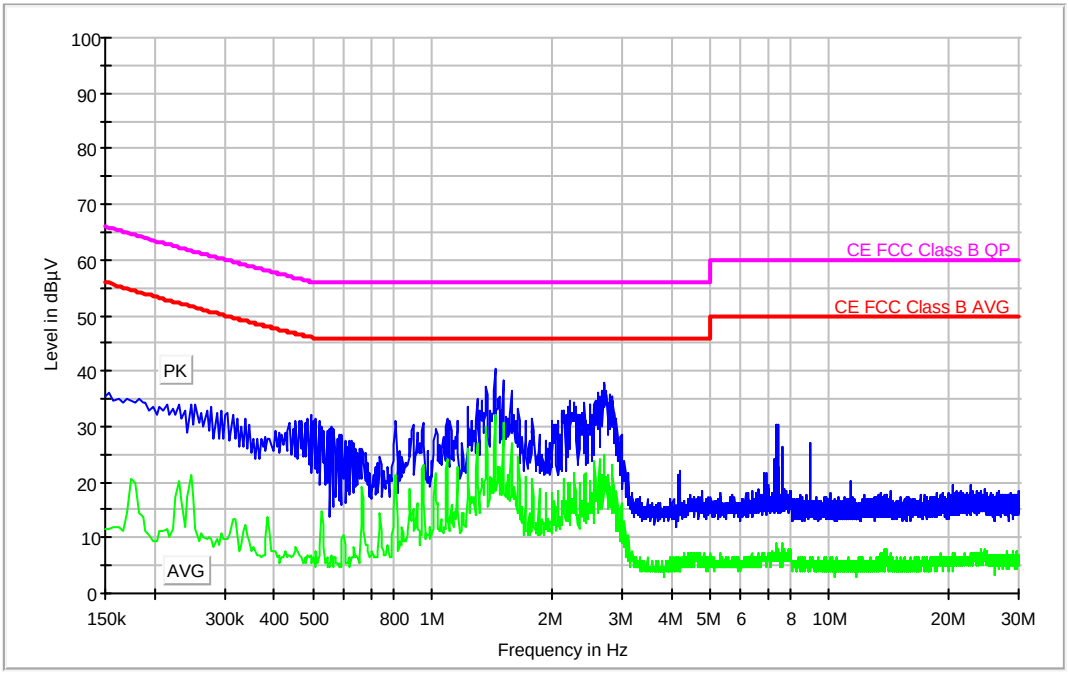
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.158000	37.5	13.2
0.238000	34.6	12.3
0.494000	32.3	7.0
0.810000	31.6	21.8
1.298000	35.3	28.0
1.370000	40.6	31.1
2.702000	39.7	24.0
3.306000	25.2	6.4
6.518000	31.8	7.8
8.662000	29.7	8.9
14.202000	28.0	6.5
26.818000	26.0	7.4

Continuous Conducted emission : CC0202L1	Detector : Peak / Average / Cuasi-peak

Project: 32032REM.001
Company: TELIT
Sample: S/02
Operation mode: OM#02
Setup: EMI conducted
Mode: EUT ON. TCH mode. Modulated carrier transmission. Phase noise.

EC FCC Class B ESIB26 ALC



Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.154000	36.1	11.4
0.246000	34.0	21.5
0.494000	32.2	7.0
0.810000	31.1	21.1
1.298000	35.0	27.2
1.438000	40.3	32.1
2.702000	37.8	23.3
4.190000	21.9	6.4
7.454000	30.5	7.8
8.998000	27.1	5.7
14.270000	18.4	5.8
20.510000	19.5	5.9