DEKRA Testing and Certification, S.A.U.
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DEKRA

Test report No:
NIE: 71232REM.001A1

Test report

FCC Rules and Regulations CFR 47, Part 15, Subpart B and C (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)

(*) Identification of item tested	LTE Cat-M Cellular communication module in SiP packaging
(*) Trademark	Sequans Communications
(*) Model and /or type reference	SKY66431
Other identification of the product	FCC ID: 2AAGM66431 IC: 12732A-66431
(*) Features	LTE-M, 3GPP LTE Release 14 HW Version: V1 SW Version: LR8.0.6.1-56267
Applicant	SEQUANS COMMUNICATIONS 55 Boulevard Charles de Gaulle, 92700 Colombes, France
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B and C (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager 2022.11.18 11:06:32 +01'00'
Date of issue	2022-11-18
Report template No	FDT08_24 (*) "Data provided by the client"

Index

Acronyms

Acronym ID	Acronym Description
Code	EMC Test Code
Freq Rng	Frequency Range
MP	Measurement Point
OM	Operation Mode
S/	Sample
V	Verdict

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. 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 DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.

The results presented in this Test Report apply only to the particular item under test established in this document.

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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.
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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the measured conducted disturbance characteristics of EUT from 150 kHz to 30 MHz is I = ± 3,9 dB for quasi-peak measurements, I = ± 3,2 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 1000 MHz is I = ± 4,9 dB for quasi-peak measurements, I = ± 4,6 dB for peak measurements (k= 2).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1000 MHz to 12.75 GHz is I = ± 2,6 dB for peaks and average measurements (k = 2).

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested"

2. The sample consists of a LTE Cat-M Cellular communication module in SiP packaging. Most compact LTE modem and RF front-end in a single package: − Same chipset as GM02S module i.e. SQN3430 - Integrated baseband, transceiver, RF front end, RAM memory, crystals and power management − 8.8 x 11.3 x 1.585 (max.) mm BGA package, 0.5 and 1 mm pitch -Compliant to 3GPP Rel-14, upgradeable to 3GPP Rel-15 & 16 -Optimized for half-duplex operation (HD-FDD) for LTE-M.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	71232B_3.1	LTE Cat-M Cellular communication module in SiP packaging	SKY66431	163	2022-07-14	Element under test

Notes referenced to samples during the project: None.

Test sample description

Ports…… :	Port name and description	Cable							
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)				
	USB	2	[X]	[ ]	[ ]				
	.....	.....	[ ]	[ ]	[ ]				
	.....	.....	[ ]	[ ]	[ ]				
	.....	.....	[ ]	[ ]	[ ]				
	.....	.....	[ ]	[ ]	[ ]				
	.....	.....	[ ]	[ ]	[ ]				
Supplementary information to the ports…… :	.....								
Rated power supply .....:	Voltage and Frequency		Reference poles						
			L1	L2	L3	N	PE		
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]		
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]		
	[X]	DC: 3.3V USB port							
	[ ]	DC:							
Rated Power .....:	.....								
Clock frequencies.....:	.....								
Other parameters .....:	.....								
Software version .....:	.....								
Hardware version .....:	.....								
Dimensions in cm (W x H x D) ....:	.....								
Mounting position .....:	[X]	Table top equipment							
	[ ]	Wall/Ceiling mounted equipment							
	[ ]	Floor standing equipment							
	[ ]	Hand-held equipment							

	[ ] Other:		
Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	NEKTAR-EVK	.....	.....
	USB Cable	.....	.....
	External antenna	.....	.....
	.....	.....	.....
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
Documents as provided by the applicant.....:	Description	File name	Issue date
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....

(3) Only for Medical Equipment

Identification of the client

SEQUANS COMMUNICATIONS
55 Boulevard Charles de Gaulle, 92700 Colombes

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-07-28
Date (finish)	2022-07-28

Document history

Report number	Date	Description
71232REM.001	2022-11-152022-11-18	First release
71232REM.001A1	2022-11-18	This test is modified adding missing information. This modification test report cancels and replaces the test report #71232REM.001#.

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. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860mbar Max. = 1060mbar

Remarks and comments

The tests have been performed by the technical personnel: Carlos Haro López.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P
Partial Passed	P*

List of equipment used during the test

Control No.	Equipment	Model	Manufacturer	Next Calibration
6132	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-05-09
6126	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2023-05-04
4684	HIGH GAIN LOG-PERIODIC ANTENNA 80MHz-3GHz	HL046E	ROHDE AND SCHWARZ	--
4612	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2024-07-13
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
5641	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2024-09-15
8856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2022-09-08
6204	THREE-PHASE ARTIFICIAL NETWORK 32A	PMM L3-32	NARDA	2023-09-27
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	--

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	RE Radiated emission. Electromagnetic field measure	Pass	--
FCC CFR 47, Part 15, Subpart B and C (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	CE Continuous conducted emission	Pass	--
Supplementary information and remarks: None.			

Appendix A: Test results

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.

The operation modes used by the samples to which the present report refers are shown in the next table:

Id	Description
OM/01	EUT ON. Module ON. MS in IDLE mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac.
OM/02	EUT ON. Module ON. MS in Traffic mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac.

Test standards version applied

The product standards and test standards applied for each test cases are shown in the next table:

Product Test Standard	Test standard	Requirement – Test case
FCC CFR 47, Part 15, Subpart B (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.
FCC CFR 47, Part 15, Subpart B and C (10-1-21 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	CE Continuous conducted emission

Test Cases Details

FCC 47 CFR Part 15B

RE Radiated emission. Electromagnetic field measure

Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-21 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

Frequency range (MHz)	FCC Part 15B		ICES-003 Issue 7		FCC Part 15B & ICES-003 Issue 7	
	QP Limit for 3 m		QP Limit for 3 m		PK Limit for 3 m	AVG Limit for 3 m
	(μV/m)	(dBμV/m)	(μV/m)	(dBμV/m)	(dBμV/m)	(dBμV/m)
30 to 88	100	40	100	40	---	---
88 to 216	150	43.5	150	43.5	---	---
216 to 230	200	46	200	46	---	---
230 to 960	200	46	224	47		
960 to 1000	500	54	500	54	---	---
Above 1000	---	---	---	---	74	54

Limits according to FCC Part 15B, equal to o more stringent than those of ICES-003 Issue 7.

Results

S/	OM	Code	Freq Rng (MHz)	V
01	OM/01	RE0101LR	[30, 1000]	P
01	OM/01	RE0101HR	[1000, 12750]	P

Verdict

Pass

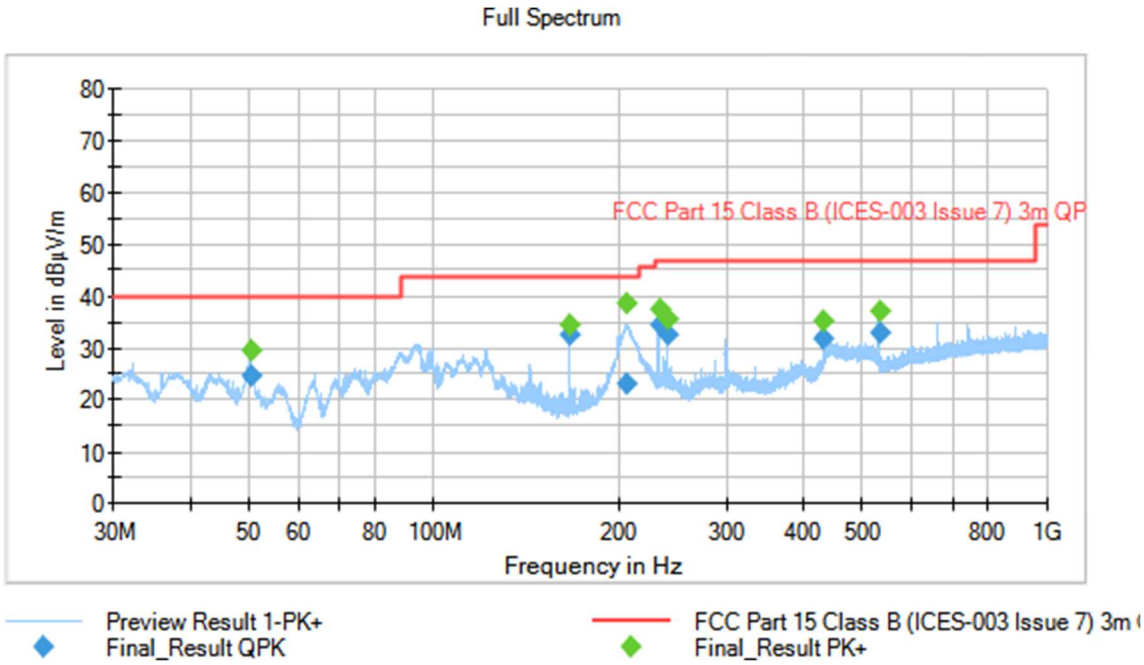
Attachments

EMC Test Code = RE0101LR, Frequency Range MHz = [30, 1000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Module ON. MS in IDLE mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac.

Images:



Tables:

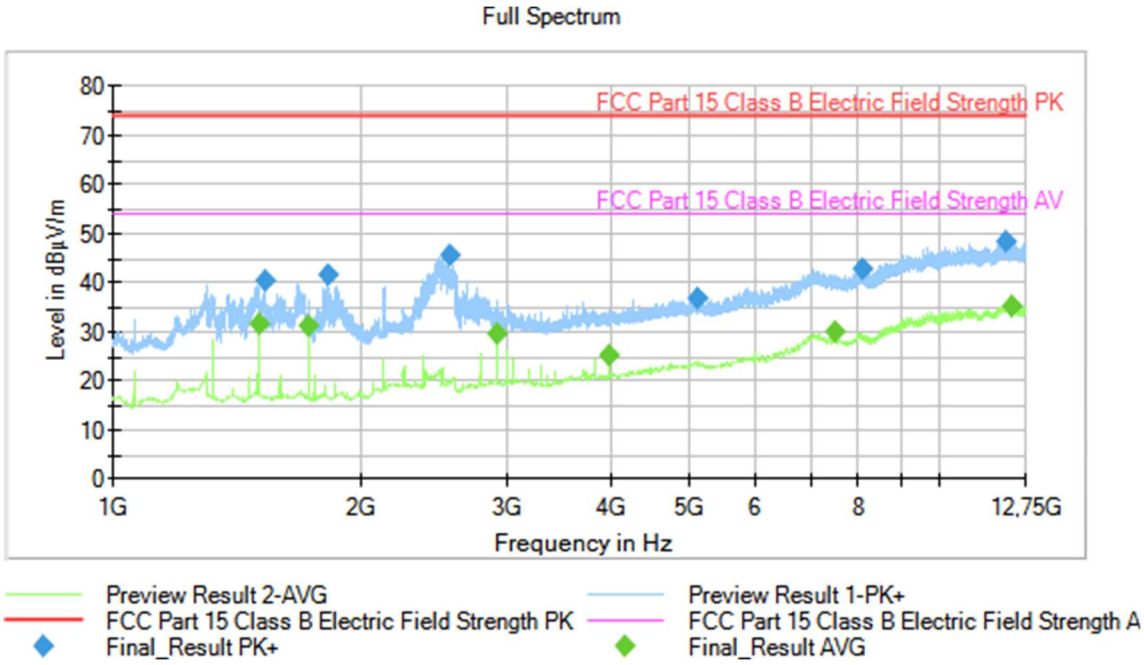
Frequency(MHz)	QuasiPeak(dBµV/m)	MaxPeak(dBµV/m)	Limit(dBµV/m)	Margin(dB)	Height(cm)	Pol	Azimuth(deg)
50.215000	---	29.56	---	---	165.0	H	83.0
50.215000	24.63	---	40.00	15.37	165.0	H	83.0
166.280000	---	34.53	---	---	122.0	V	-87.0
166.280000	32.45	---	43.52	11.07	122.0	V	-87.0
206.211000	---	38.56	---	---	235.0	V	-70.0
206.211000	23.14	---	43.52	20.38	235.0	V	-70.0
232.788000	---	37.37	---	---	126.0	V	15.0
232.788000	34.69	---	47.00	12.31	126.0	V	15.0
240.003000	---	35.46	---	---	122.0	V	16.0
240.003000	32.53	---	47.00	14.47	122.0	V	16.0
432.008000	---	35.24	---	---	131.0	H	87.0
432.008000	31.66	---	47.00	15.34	131.0	H	87.0
532.146000	---	37.23	---	---	150.0	V	-94.0
532.146000	33.08	---	47.00	13.92	150.0	V	-94.0

EMC Test Code = RE0101HR, Frequency Range MHz = [1000, 12750]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Module ON. MS in IDLE mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac.

Images:



Tables:

Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1500.000000	---	31.55	53.97	22.42
1526.750000	40.31	---	73.97	33.66
1722.500000	---	31.03	53.97	22.94
1816.750000	41.60	---	73.97	32.37
2551.000000	45.51	---	73.97	28.46
2915.000000	---	29.63	53.97	24.34
3975.000000	---	25.00	53.97	28.97
5099.500000	36.61	---	73.97	37.36
7500.000000	---	29.96	53.97	24.01
8092.750000	42.68	---	73.97	31.29
12079.500000	48.26	---	73.97	25.71
12300.000000	---	35.21	53.97	18.76

CE Continuous conducted emission

Limits of interference 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 and C (10-1-21 Edition), Secs. 15.107 and 15.207 & ICES-003 Issue 7 (October 2020), in the frequency range 0,15 to 30 MHz, for Class B equipment was:

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

*Decreases with the logarithm of the frequency.

Results

S/	OM	Code	Freq Rng (MHz)	Line	Comments	V
01	OM/01	CE01010N	[0.15, 30]	N		P
01	OM/01	CE0101L1	[0.15, 30]	L1		P
01	OM/02	CE01020N	[0.15, 30]	N		P
01	OM/02	CE0102L1	[0.15, 30]	L1		P

Verdict

Pass

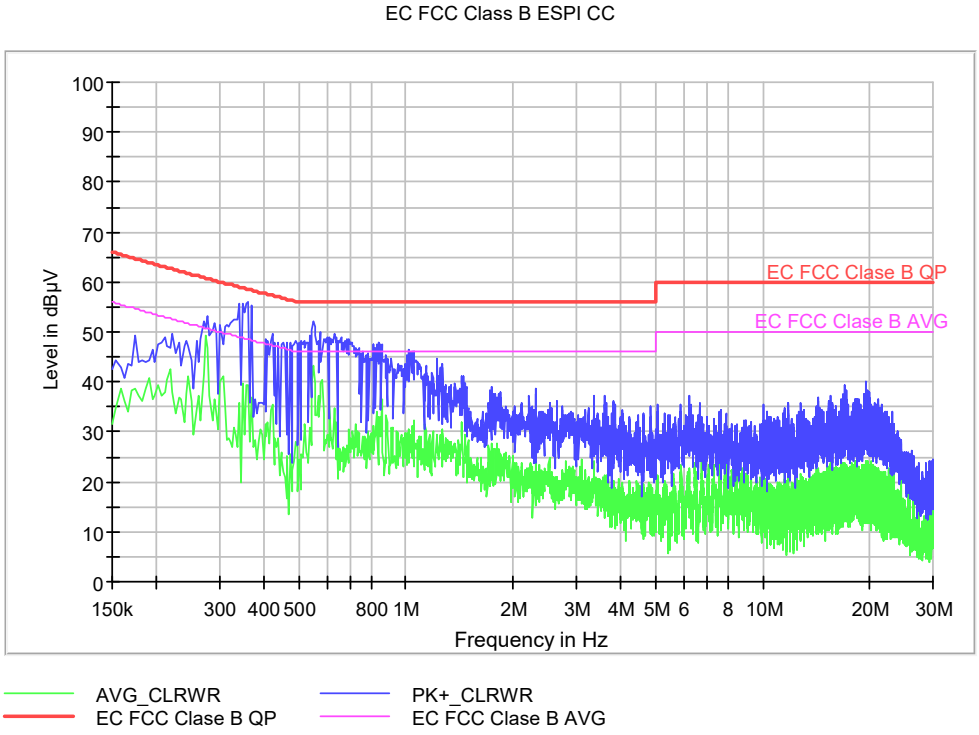
Attachments

EMC Test Code = CE01010N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Module ON. MS in IDLE mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac. Neutral wire noise

Images:



Subrange Maxima

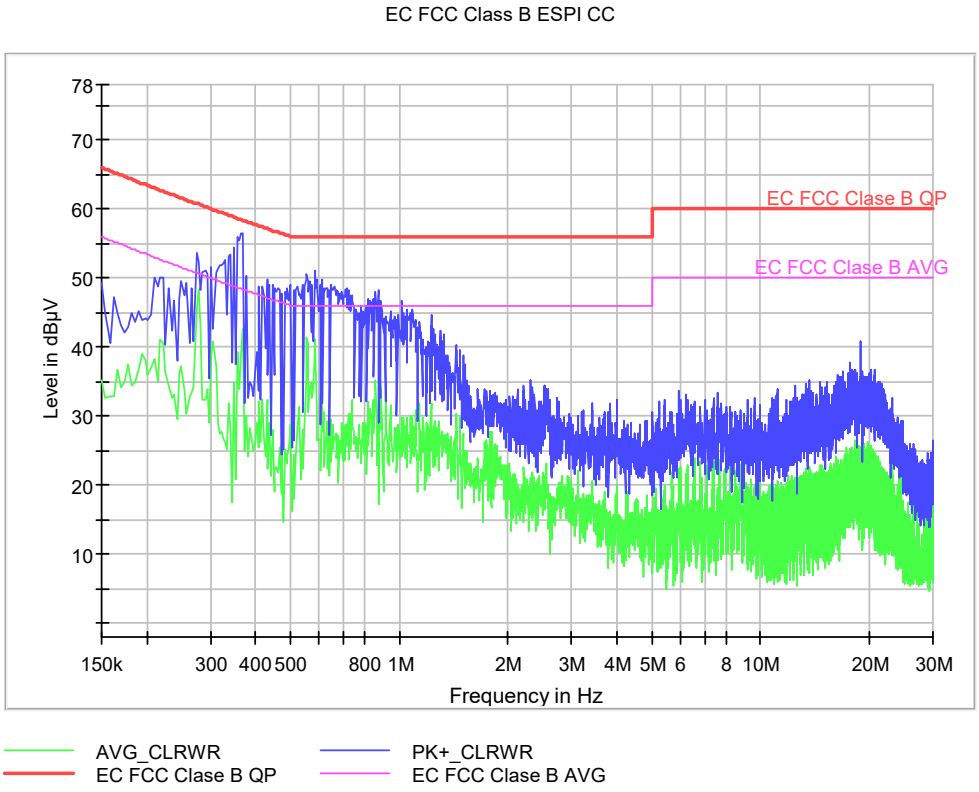
Frequency (MHz)	PK+_CLRWR (dBµV)	AVG_CLRWR (dBµV)
0.362000	55.9	39.2

EMC Test Code = CE0101L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Module ON. MS in IDLE mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac. Phase wire noise

Images:



Subrange Maxima

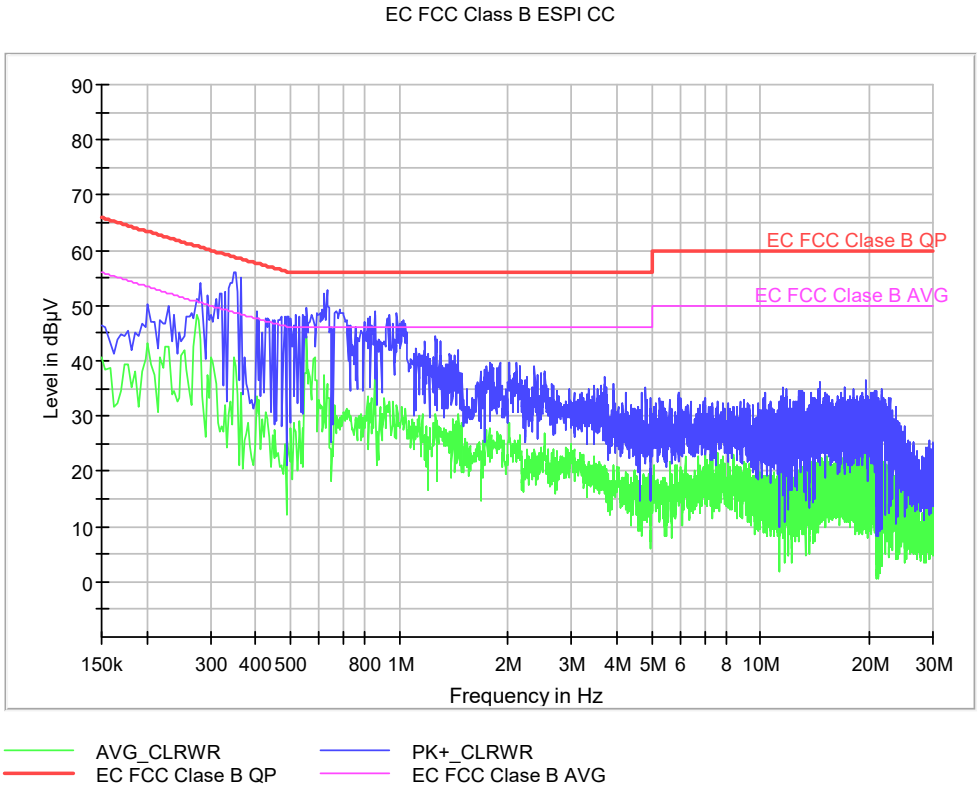
Frequency (MHz)	PK+_CLRWR (dBµV)	AVG_CLRWR (dBµV)
0.366000	**56.4**	**39.1**

EMC Test Code = CE01020N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Module ON. MS in Traffic mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac. Neutral wire noise

Images:



Subrange Maxima

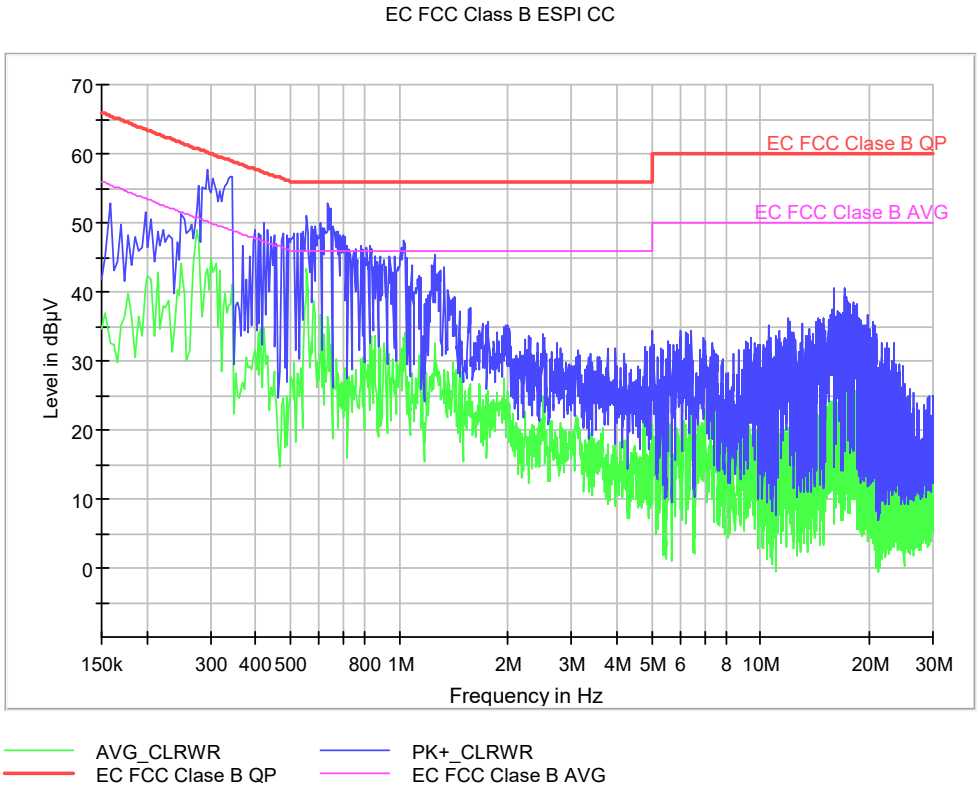
Frequency (MHz)	PK+_CLRWR (dBµV)	AVG_CLRWR (dBµV)
0.350000	56.0	40.6

EMC Test Code = CE0102L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Module ON. MS in Traffic mode. LTE NB-IoT Band 5 (worst case). Power Supply: 3.3 Vdc (By USB port). Auxiliary PC for ANSI, setup powered 115 Vac. Phase wire noise

Images:



Subrange Maxima

Frequency (MHz)	PK+_CLRWR (dBµV)	AVG_CLRWR (dBµV)
0.294000	**57.6**	**43.4**