PHOENIX TESTLAB

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FCC RF Exposure Evaluation

Report Number:

F231570E7

Equipment under Test (EUT):

NB-IoT modem inside ZONESCAN AI Leak Logger

Applicant:

Gutermann Technology GmbH

Manufacturer:

Gutermann Technology GmbH

ilac-MRA

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

CFR 47 Rule part 1 Practice and Procedure

CFR 47Rule part 2 Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

KDB 447498 D01 General RF Exposure Guidance v06

Assessed and written by:	Mohamed Yassine Khalek 22.03.2024	Signature
Reviewed and approved by:	Manuel BASTERT 22.03.2024	Signature

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1. Identification

1.1. Applicant

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Str. 10, 88214 Ravensburg
Country:	Germany
Person for contact purposes:	Mr. Carles ESTELLERS CASAS
Phone:	+49 751-359016-89
eMail address:	carles.estellers@gutermann-water.com
Applicant represented during the test by the following person:	None

1.2. Manufacturer

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Str. 10, 88214 Ravensburg
Country:	Germany
Name for contact purposes:	Mr. Carles ESTELLERS CASAS
Phone:	+49 751-359016-89
eMail address:	carles.estellers@gutermann-water.com
Manufacturer represented during the test by the following person:	None

1.3. Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
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Accredited by *Deutsche Akkreditierungsstelle GmbH* in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-06.

1.4. EUT (Equipment under Test)

Type of equipment: *	NB-IoT modem
Type / PMN: *	ZSAI Modem
Product number: *	NA
FCC ID: *	ZSS-ZSAIBC660K
IC certification number: *	9789A-ZSAIBC660K
HVIN (Hardware Version Identification Number): *	GTBC660K
FVIN (Firmware Version Identification Number): *	NBR01AI01
HMN (Host Marketing Name)	ZSNB-L20
EUT marking:	NA

* Declared by the applicant

1.5. Technical Data of Equipment

EUT						
Manufacturer:	Quectel					
Model name: *	BC660K-GL					
Power supply module: *	by host					
Supply voltage module: *	U_{nom} =	NA	U_{min} =	NA	U_{max} =	NA
Serial Number: *	MPY23IE19029979					
IMEI: *	863663063363726					
Supported bands: *	2G: None		3G: None		LTE NB-IoT: 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 18, 19, 20, 25, 28, 66, 70, 85	
Max. output power: *	LTE (max. 25.7 dBm)					
Antenna type: *	External monopole antenna					
Gain: * (max) (On a 10 cm x 10 cm groundplane with ANT-BASE-06)	ANT-ROD-30 (Bands 1, 2, 3, 4, 25, 66, 70) 1.4 dBi @ 1695 MHz -0.2 dBi @ 1845 MHz -2.15 dBi @ 1980 MHz					
	ANT-ROD-65 (Band 8) -2.3 dBd @ 880 MHz -2.5 dBd @ 897 MHz -3.4 dBd @ 915 MHz					
	ANT-ROD-76 (Bands 5, 18, 19, 20) -3.0 dBd @ 814 MHz -3.0 dBd @ 838 MHz -2.3 dBd @ 862 MHz					
	ANT-ROD-90 (Bands 12, 13, 17, 28, 85) -2.8 dBd @ 698 MHz -1.8 dBd @ 743 MHz -3.4 dBd @ 787 MHz					

Gain: * (max)	ANT-ZS-FLEX-30 (Band 1, 2, 3, 4, 25, 66, 70): -4.2 dBi @ 1695 MHz -3.3 dBi @ 1845 MHz -5.2 dBi @ 1980 MHz
	ANT-ZS-FLEX-65 (Band 8) -4.2 dBd @ 880 MHz -4.4 dBd @ 897.5 MHz -5.1 dBd @ 915 MHz
	ANT-ZS-FLEX-76 (Band 5, 18, 19, 20, 26): -5.3 dBd @ 814 MHz -5.8 dBd @ 838 MHz -4.8 dBd @ 862 MHz
	ANT-ZS-FLEX-90 (Band 12, 13, 17, 28, 85): -3.1 dBd @ 698 MHz -5.6 dBd @ 743 MHz -5.6 dBd @ 787 MHz

Host	
Power supply: *	Battery powered
Supply voltage: *	U = 3.6 V
Temperature range: *	-30°C to +70°C
Highest internal clock / generated frequency: *	1915 MHz

* Declared by the applicant

2. Subject of Investigation

According to the CFR47 §2.1091 the device as declared by the applicant is a mobile device which is used at least at 20 cm separation distance between the device and the users.

This document includes the RF-Exposure evaluation for the NB-IoT Module with the FCC ID: ZSS-ZSAIBC660K integrated in the .Host ZONESCAN AI Leak Logger ZSNB-L20 with the antennas described above.

3. MPE evaluation limits

3.1. Stand alone MPE evaluation limits

The human exposure to RF emissions from such devices could be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and / or power density. The limits for General Population / Uncontrolled Exposure are given in the following table from §1.1310(e)1:

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm²]	Averaging Time $\|E\|^2$,$\|H\|^2$ or S [min]
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	-	-	f/1500	30
1500 – 100,000	-	-	1.0	-

Limits for General Population / Uncontrolled Exposure.

Note: f = frequency in MHz; * Plane – wave equivalent power density

3.2. Simultaneous transmission MPE requirements

According to the RF exposure KDB 447498 D01 General RF Exposure Guidance v06 in chapter 7.2:
For mobile exposure host platform devices to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must either be evaluated for MPE compliance, by measurement or computational modelling, or qualify for the standalone MPE test exclusion in 7.1.

When modular transmitters are used, the minimum test separation distance required for each simultaneously transmitting antenna installed in the host device must satisfy MPE compliance for both standalone and simultaneous transmission operations. When simultaneous transmission MPE test exclusion applies, transmitter modules may be incorporated in host devices according to Class I permissive change requirements to document the test exclusion conditions.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is
≤ 1.0, according to calculated/estimated, numerically modelled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency.

4. MPE evaluation

The power density is calculated as follows:

$$Power\ density = \frac{P \cdot G}{4 \cdot \pi \cdot R^2}$$

Where:

P: conducted power

G: Antenna gain (linear)

R: minimum separation distance from antenna to the user

4.1. Stand-alone MPE results

Band	Frequency [MHz]	Highest RF conducted output power [dBm]	Power + Tune up tol. [dBm]	Duty cycle [dB]	Antenna Gain [dBi]	Distance [cm]	Power Density [mW/cm²]	Limit of Power Density [mW/cm²]	Reference
NB-IoT LTE Bd 5	824.0	23.68	25.0	-	-0.85	20	0.05	0.549	Module report *1
NB-IoT LTE Bd 66	1710.0	23.68	25.0	-	1.4	20	0.09	1.0	Module report *1
NB-IoT LTE Bd 85	698.0	23.73	25.0	-	-0.65	20	0.054	0.4653	Module report *1
NB-IoT LTE Bd 25	1850.0	23.71	25.0	-	-0.2	20	0.06	1.0	Module report *1
NB-IoT LTE Bd 13	777.0	23.68	25.0	-	0.35	20	0.069	0.518	Module report *1

*1 Module report 2012RSU022-U5 issued by MRT Technology (Suzhou) Co., Ltd 2021-06-04

5. Conclusion

The EUT complies with the MPE limits from §1.1310(e)1.

6. Report History

Report Number	Date	Comment
F231570E7	22.03.2024	Initial Test Report
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-	-	-