TEST REPORT

No. I18D00094-SAR01

For

Client : Gemalto M2M GmbH

Production : EHS5-US

Model Name : EHS5-US R4

FCC ID: QIPEHS5-USR4

IC ID: 7830A-EHS5USR4

Hardware Version: B2.1

Software Version: 04.000

Issued date: 2018-10-12

Test Laboratory:

ECIT Shanghai, East China Institute of Telecommunications

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Revision Version

Report Number	Revision	Date	Memo
I18D00094-SAR01	00	2018-10-12	Initial creation of test report

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1. Test Laboratory

1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area,No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
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1.2. Project Data

Project Leader:	Zhou Yan

1.3. Signature

Yan Hang
(Prepared this test report)

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(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	Gemalto M2M GmbH
Address	Gemalto M2M GmbH, Werinherstrasse 81 81541 München, Germany
Telephone:	+861059378342
Postcode:	/

2.2. Manufacturer Information

Company Name:	Gemalto M2M GmbH
Address /Post:	Gemalto M2M GmbH, Werinherstrasse 81 81541 München, Germany
Telephone:	+861059378342
Postcode:	/

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

3.1. About EUT

EUT Description	EHS5-US
Model name	EHS5-US
GSM Frequency Band	GSM850/1900
WCDMA Frequency Band	WCDMA Band II (1900) / WCDMA Band V (850)
Antenna Type	External Antenna
FCC ID:	QIPEHS5-USR4
IC ID:	7830A-EHS5USR4

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version:
N01	N/A	B2.1	04.000

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

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
N/A	N/A	N/A	N/A	N/A

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

4. Power Output Test Results

4.1. RF Power Output

Frequency Band	Max power(dBm)	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)
WCDMA band II (1900)	24.5	24.5	2.15
WCDMA band V (850)	24.5	24.5	5.15
GSM850	33.5	24.47	5.15
GSM1900	30.5	21.47	2.15

4.2. Duty cycle

Mode	Duty Cycle
GSM	1:8.3
WCDMA	1:1

5. Reference Documents for FCC

5.1. Applicable Standards

The MPE report was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2.1091.
FCC CFR 47, Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS, Oct 1,2011
Section 2.1091 Radiofrequency radiation exposure evaluation: mobile devices, June 23, 2015

5.2. Test Limits

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

Limits for Occupational / Controlled Exposure

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm2]	Averaging Times |E|2, |H|2 or S [miniutes]
0.3 – 3.0	614	1.63	(100)*	6
3.0 – 30	1824/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	--	--	F/300	6
1500 - 100000	--	--	5	6

Limits for General Population / Uncontrolled Exposure

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm2]	Averaging Times |E|2, |H|2 or S [miniutes]
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 - 100000	--	--	1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density
For the DUT, the limits for General Population / Uncontrolled Exposure are applicable.

FCC: §1.1307	Cellular Radiotelephone Service (subpart H of part 22) Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)
FCC §1.1307	Personal Communications Services (part 24) Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)
FCC §1.1310	LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) Table 1(B) Limits for General Population/Uncontrolled Exposure 300–1500 MHz: f/1500 mW/cm² 1500–100,000 MHz: 1.0 mW/cm² Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their
FCC §2.1091	effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is3 watts or more.(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna
FCC §24.232	height up to 300 meters HAAT. b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, …
FCC §22.913	(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.
FCC §27.50 (C)(10)	(10) Portable stations (hand-held devices) are limited to 3 watts ERP; and
FCC §27.50(d)	(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 1 watt EIRP.

5.3. Calculation Information

For conservative evaluation consideration, only maximum power of each frequency band based on the tighter limits respectively are used to calculate the boundary power density.

Based on the FCC KDB 447498 D01 and 47 CFR §2.1091, the DUT is evaluated as a mobile device.

Given $S = \frac{P \times G}{4\Pi d^2}$ ***Equation 1***

Where
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Band	Frequency (MHz)	Highest Frame-Averaged Output Power (dBm)	Limit mW/m²	Antenna Gain（dBi）	Numeric antenna gain	Power density at 20cm	Limit mW/cm²
WCDMA band II (1900)	1852.4	24.5	1	2.15	1.641	0.092	1
WCDMA band V (850)	826.4	24.5	0.556	5.15	3.273	0.184	0.556
GSM850	824.2	24.47	0.556	5.15	3.273	0.182	0.556
GSM1900	1850.2	21.47	1	2.15	1.641	0.046	1

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band

5.4. Max. Antenna gain calculations

Maximum antenna gain considerations for fixed/mobile operations for complying with limits:

Band	Highest Frame-Averaged Output Power (dBm)	Limit mW/cm²	Max antenna gain at 20cm(dBi)
WCDMA band II (1900)	24.5	1	12.51
WCDMA band V (850)	24.5	0.556	9.96
GSM850	24.47	0.556	9.99
GSM1900	21.47	1	15.54

Power limit according to §2.1091 [W]:

Band	Highest Frame-Averaged Output Power (dBm)	Limit (W) (ERP)	Max antenna gain at 20cm(dBi)
WCDMA band II (1900)	24.5	1.5	9.41
WCDMA band V (850)	24.5	3	12.42
GSM850	24.47	3	12.45
GSM1900	21.47	1.5	12.44

Power limit according to §22.913; §24.232 [W]:

Band	Highest Frame-Averaged Output Power (dBm)	Limit (W) EIRP	Max antenna gain (dBi)

WCDMA band II (1900)	24.5	2.0	8.51
GSM1900	21.47	2.0	11.54
Band	Highest Frame-Averaged Output Power (dBm)	Limit (W) ERP	Max antenna gain (dBi)
WCDMA band V (850)	24.5	7.0	16.10
GSM850	24.47	7.0	16.13

5.5. Conclusion for maximum admissible antenna gain (FCC)

Band	Maximum admissible antenna gain (dBi)
WCDMA band II (1900)	8.51
WCDMA band V (850)	9.96
GSM850	9.99
GSM1900	11.54

Note: Using frequency in 824~849MHz allows the use of antenna gain biggest 9.96dBi.
Using frequency in 1850~1910MHz allows the use of antenna gain biggest 8.51dBi.

6. Reference Documents for IC

6.1. Applicable Standards

RSS 102 Issue 5 :Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

6.2. Test Limits

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

• below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 22.48/f0.5 W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10^{-2} $f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

RSS 132	The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base station e.i.r.p. limits.
SRSP-510	5.1.2 Mobile Stations Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. The equipment shall employ means to limit the power to the minimum necessary for successful communication.

6.3. RF Power Output

Frequency Band	Max power(dBm)	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)
WCDMA band II (1900)	24.5	24.5	2.15
WCDMA band V (850)	24.5	24.5	5.15
GSM850	33.5	24.47	5.15
GSM1900	30.5	21.47	2.15

6.4. Calculation Information

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;

6.5. Result of EUT

The MPE limit for Occupational/Controlled Exposure is shown in the RSS 102 issue 5 section 2.5.2, can be calculated as follows:

Frequency Band	**Highest Output Power (dBm)**	**Antenna Gain(dBi)**	**EIRP/EIP（W）**	MPE limit (W)
WCDMA band II (1900)	24.5	2.15	0.462	2.24
WCDMA band V (850)	24.5	5.15	0.923	1.290
GSM850	24.47	5.15	0.916	1.290
GSM1900	21.47	2.15	0.230	2.24

As we can see the resulted EIRP is below the MPE limit, therefore the DUT in this band is compliant with the IC rules on RF exposure.

6.6. Max. Antenna gain calculations

Maximum antenna gain considerations for fixed/mobile operations for complying with limits according to RSS 102:

Band	Frequency (MHz)	Highest Output Power (dBm)	MPE limit (W)	Max antenna gain at 20cm(dBi)
WCDMA band II (1900)	1852.4	24.5	2.24	9.00
WCDMA band V (850)	826.4	24.5	1.290	6.61
GSM850	824.2	24.47	1.290	6.64
GSM1900	1850.2	21.47	2.24	12.03

Power limit according to RSS 132; SRSP-510:

Band	Highest Frame-Averaged Output Power (dBm)	Limit (W) EIRP	Max antenna gain (dBi)
WCDMA band II (1900)	24.5	2.0	8.51
GSM1900	24.5	2.0	8.51
WCDMA band V (850)	24.47	11.5	16.14
GSM850	21.47	11.5	19.14

6.7. Conclusion for maximum admissible antenna gain (IC)

Band	Maximum admissible antenna gain (dBi)
WCDMA band II (1900)	8.51
WCDMA band V (850)	6.61
GSM850	6.64
GSM1900	8.51

Note: Using frequency in 824~849MHz allows the use of antenna gain biggest 6.61dBi.
Using frequency in 1850~1910MHz allows the use of antenna gain biggest 8.51dBi.

7. Summary

Band	FCC Maximum admissible antenna gain (dBi)	IC Maximum admissible antenna gain (dBi)	Total Maximum admissible antenna gain (dBi)
WCDMA band II (1900)	8.51	8.51	8.51
WCDMA band V (850)	9.96	6.61	6.61
GSM850	9.99	6.64	6.64
GSM1900	11.54	8.51	8.51

Note: Using frequency in 824~849MHz allows the use of antenna gain biggest 6.61dBi.
Using frequency in 1850~1910MHz allows the use of antenna gain biggest 8.51dBi.

************End The Report************