RADIO REPORT

FCC 47 CFR Part 22H
ISED Canada RSS-132 Issue 2

Cellular Telephones Operating in the Bands 824-849 MHz and 869-894 MHz

FCC 47 CFR Part 24E
ISED RSS-133, Issue 5

2GHz Personal Communication Services

Report Reference No	G0M-1709-6865-TFC224GS-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Test Firm Designation Number: DE0008 IC Testing Laboratory site: 3470A-3
Applicant	ECD Electronic Components GmbH Dresden
Address	Heidelberger Str. 7 01189 Dresden GERMANY
Test Specification	According to FCC/ISED rules
Standard	47 CFR Part 22H, 47 CFR Part 24E RSS-132, Issue 3: 2013-01, RSS-133, Issue 6:2013-01
Non-Standard Test Method	None
Test Scope	partial compliance test
Equipment under Test (EUT):	
Product Description	Gateway
Model(s)	Connect S
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	8-RBG-0003
Software Version(s)	None
FCC-ID	2AOSY-CONNECT01
IC	N/A
Contains FCC-ID	XMR201202M95
Contains IC	N/A
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
not applicable to EUT	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 - 23 °C	
Test Lab Humidity	32 – 38 %	
Date of receipt of test item	2018-02-12	
Report:		
Compiled by	Sebastian Suckow	
Tested by (+ signature) (Responsible for Test)	Sebastian Suckow	.....
Approved by (+ signature) (Head of Lab)	Christian Weber	.....
Date of Issue	2018-03-28	
Total number of pages	34	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
The applicant has declared an additional model of the series: Connect L This model was neither tested nor assessed nor evaluated.		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2018-03-28	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RMS	Root mean square
VBW	Video bandwidth
V_{NOM}	Nominal supply voltage

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1 Equipment (Test Item) Under Test

Description	Gateway	
Model	Connect S	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	None	
Hardware Version(s)	8-RBG-0003	
Software Version(s)	None	
PMN	N/A	
HVIN	N/A	
FVIN	N/A	
HMN	N/A	
FCC-ID	2AOSY-CONNECT01	
IC	N/A	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	GSM 850 = UL : 824 - 849 MHz DL : 869 – 894 MHz GSM 1900 = UL : 1850 – 1910 MHz DL : 1930 – 1990 MHz	
Radio technology	GSM	
Operating modes	GPRS	
Modulation	GMSK	
Multislot class	12	
Number of modules	1	
Radio Module	Type	GSM Module
	Model	M95 FA
	Manufacturer	Quectel
	HW Version	M95 FA-03-STD
	SW Version	AR02A08
Antenna	Type	Integrated
	Model	PCB antenna
	Manufacturer	Unspecified
	Gain	1 dBi
Supply Voltage	V_{NOM}	3.2 VDC
AC/DC-Adaptor	Model	GS12E24
	Vendor	Mean Well
	Input	100 - 240 VAC
	Output	24
Manufacturer	ECD Electronic Components GmbH Dresden Heidelberger Str. 7 01189 Dresden GERMANY	

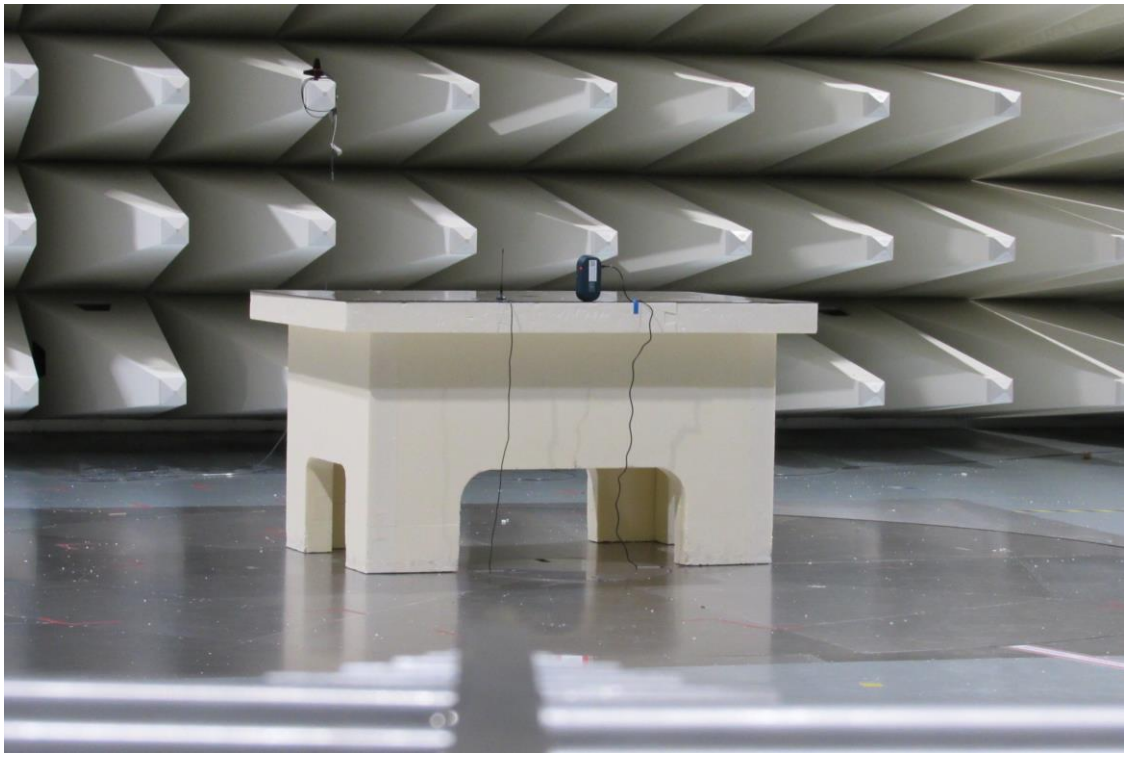
1.1 Photos – Equipment External

EUT Top

EUT Bottom

EUT Power Supply Input

1.3 Photos – Test Setup

Test Setup


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
SIM	Communication Tester	R&S	CMU200	GSM-Tester
Description:				
AE	Auxillary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
Comment:				

1.5 Test Modes

Mode	Description
GPRS	Mode = Transmit Power = Maximum Modulation = GMSK Number of time slots = 1 Duty cycle = 12.5%
Idle	Mode = Idle
Comment: Maximum power (worst case) was searched for all modulations and the various time slot configurations. Configuration with maximum burst output power was selected for compliance testing. The corresponding modes are given in this table.	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx	128	824.2
F2	Tx	188	836.2
F3	Tx	251	848.8
F4	Rx	128	869.2
F5	Rx	188	881.2
F6	Rx	251	893.8
F7	Tx	512	1850.2
F8	Tx	661	1880.0
F9	Tx	810	1909.8
F10	Rx	512	1930.2
F11	Rx	661	1960.0
F12	Rx	810	1989.8

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading	- FCC limit	= Margin
+21.5 dBµV	+ 26 dB = 47.5 dBµV/m	:	47.5 dBµV/m	- 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 22H, 24E, ISED RSS-132, 133				
Product Standard Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
RSS-Gen 6.6	Occupied Bandwidth	ANSI C63.10	N/R	Informational only
FCC §24.235 FCC §22.355 ISED RSS-132 §4.3 ISED RSS-133 §6.3	Frequency stability	FCC § 24.235 FCC § 22.355 ISED RSS-132 § 4.3 ISED RSS-133 § 6.3 KDB 971168 ANSI C63.26-2015 5.6	N/T	
FCC § 22.913(a)	Effective radiated power	ANSI/TIA-603-D KDB 971168	PASS	
FCC § 24.232(c) ISED RSS-132 § 4.4 ISED RSS-133 § 6.4	Equivalent isotropic radiated power	ANSI/TIA-603-D KDB 971168 ANSI C63.26-2015 5.2	PASS	
FCC § 24.232(d) ISED RSS-133 § 6.4	Peak to average ratio	KDB 971168	N/T	
FCC § 22.917(b) FCC § 24.238(b) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Band-edge compliance	KDB 971168	N/T	
FCC § 22.917(a) FCC § 24.238(a) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Conducted out-of-band emissions	KDB 971168 ANSI C63.26-2015 5.7	N/T	
FCC § 22.917(a) FCC § 24.238(a) ISED RSS-132 § 4.5 ISED RSS-133 § 6.5	Radiated out-of-band emissions	ANSI/TIA-603-D KDB 971168 ANSI C63.26-2015 5.5	PASS	
ISED RSS-132 § 4.6 ISED RSS-133 § 6.6 ISED RSS-Gen 7.1	Receiver radiated spurious emissions	ISED RSS-Gen 7.1 ANSI C63.4	PASS	
Comment:				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Occupied bandwidth

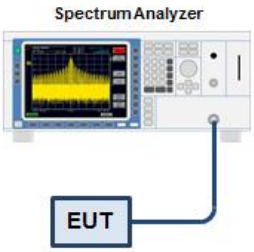
3.1.1 Information

Test Information	
Reference	ISED RSS-Gen 6.6
Measurement Method	KDB 971168/ANSI C63.26-2015 5.4
Operator	Sebastian Suckow
Date	2018-02-13

3.1.2 Limits

Limits
None (Informational only)

3.1.3 Setup

Test Setup


3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSIQ 26	EF00151	2017-07	2018-07

3.1.5 Procedure

Test Procedure
1. EUT set to test mode (Communication tester is used if needed) 2. Span set to at least twice the emission spectrum 3. Resolution bandwidth set to 1 % of span 4. Occupied Bandwidth (99 %) measurement with spectrum analyzer built in measurement function

3.1.6 Results

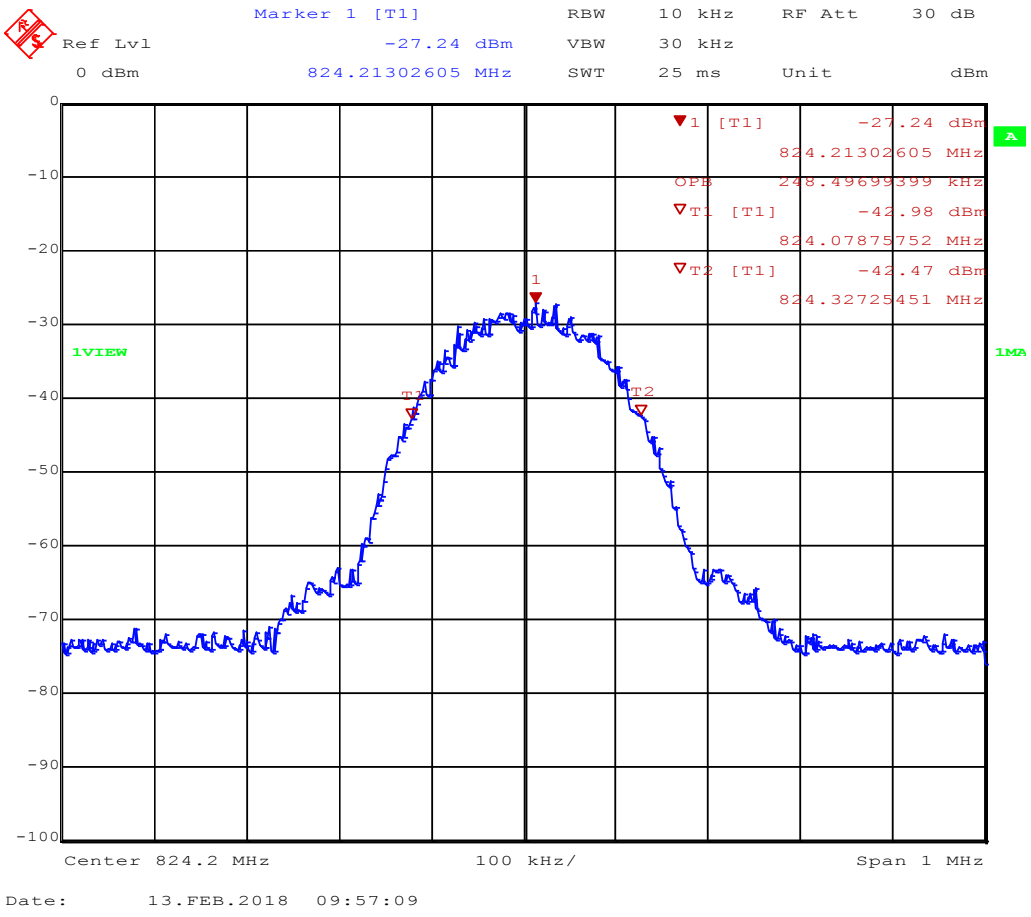
Test Results - GSM 850		
Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
824.2	GPRS	248.50
836.2	GPRS	248.50
848.8	GPRS	248.50

Test Results - GSM 1900		
Frequency [MHz]	Mode	Occupied Bandwidth [kHz]
1850.2	GPRS	248.50
1880.0	GPRS	244.49
1909.8	GPRS	250.50

Occupied Bandwidth

Project Number: G0M-1709-6865

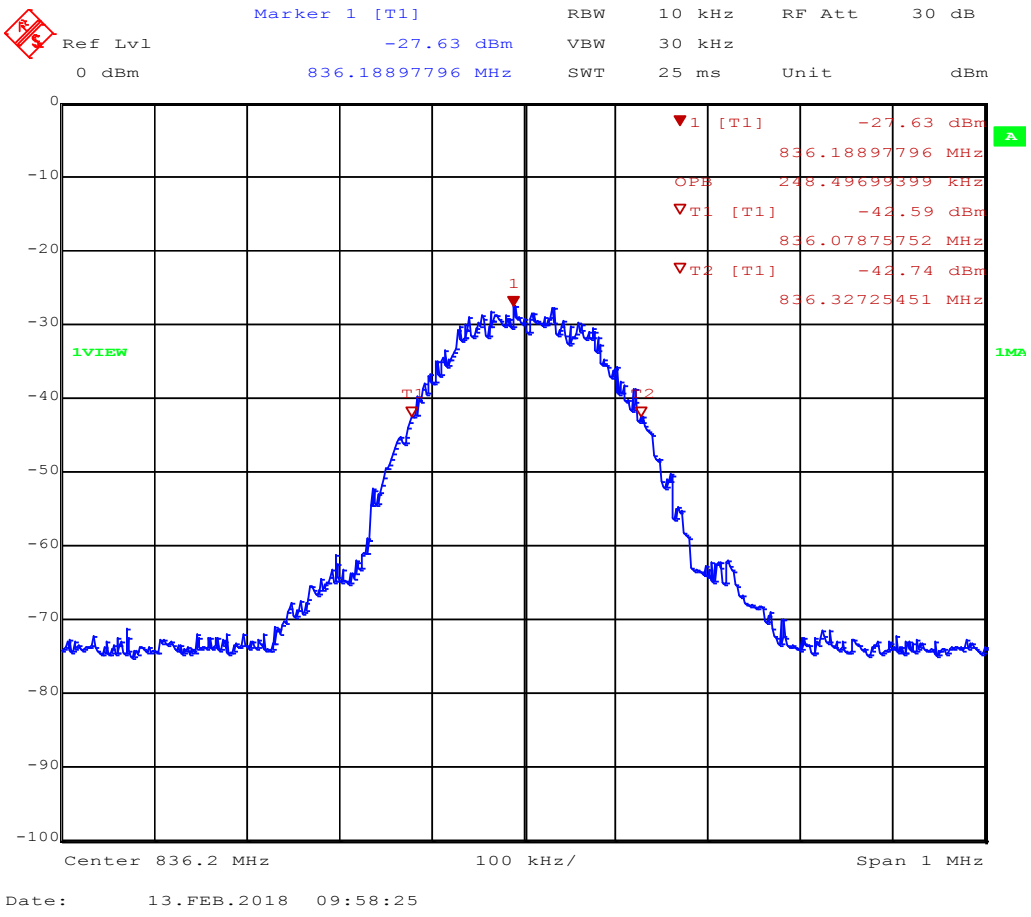
Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 128
Note 2:	Test Mode A



Occupied Bandwidth

Project Number: G0M-1709-6865

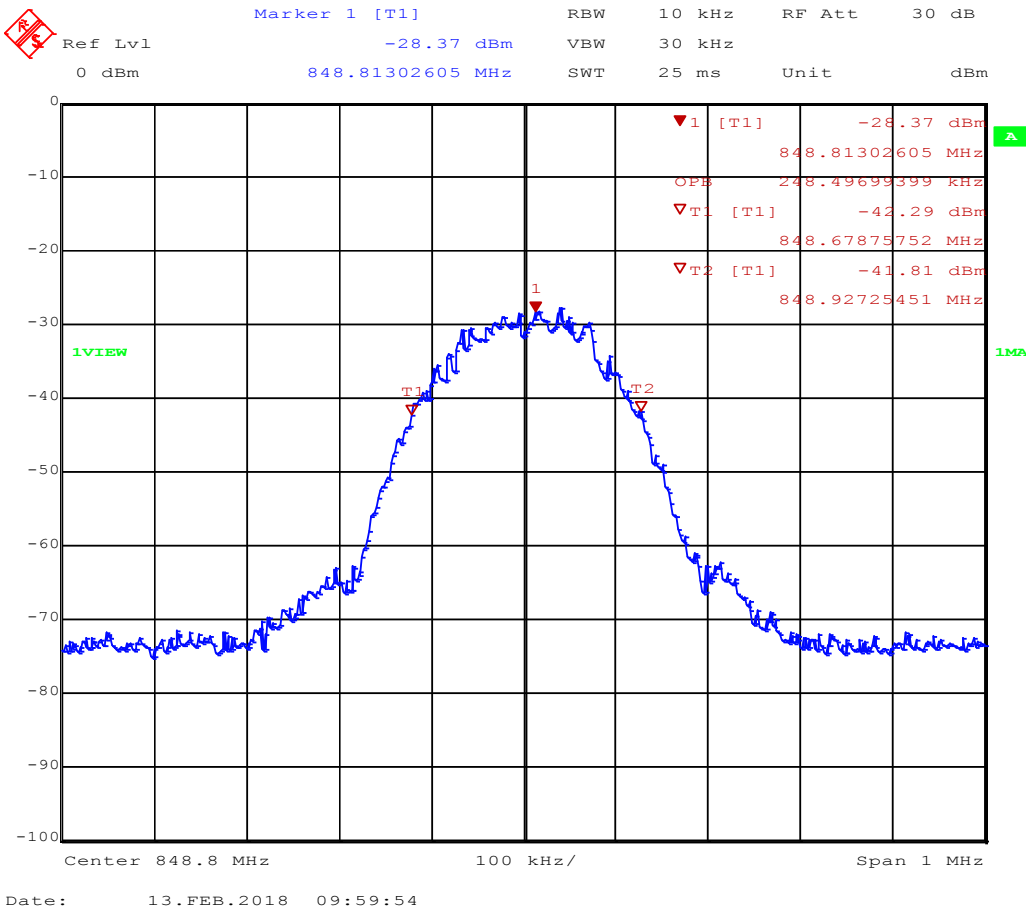
Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 188
Note 2:	Test Mode A



Occupied Bandwidth

Project Number: G0M-1709-6865

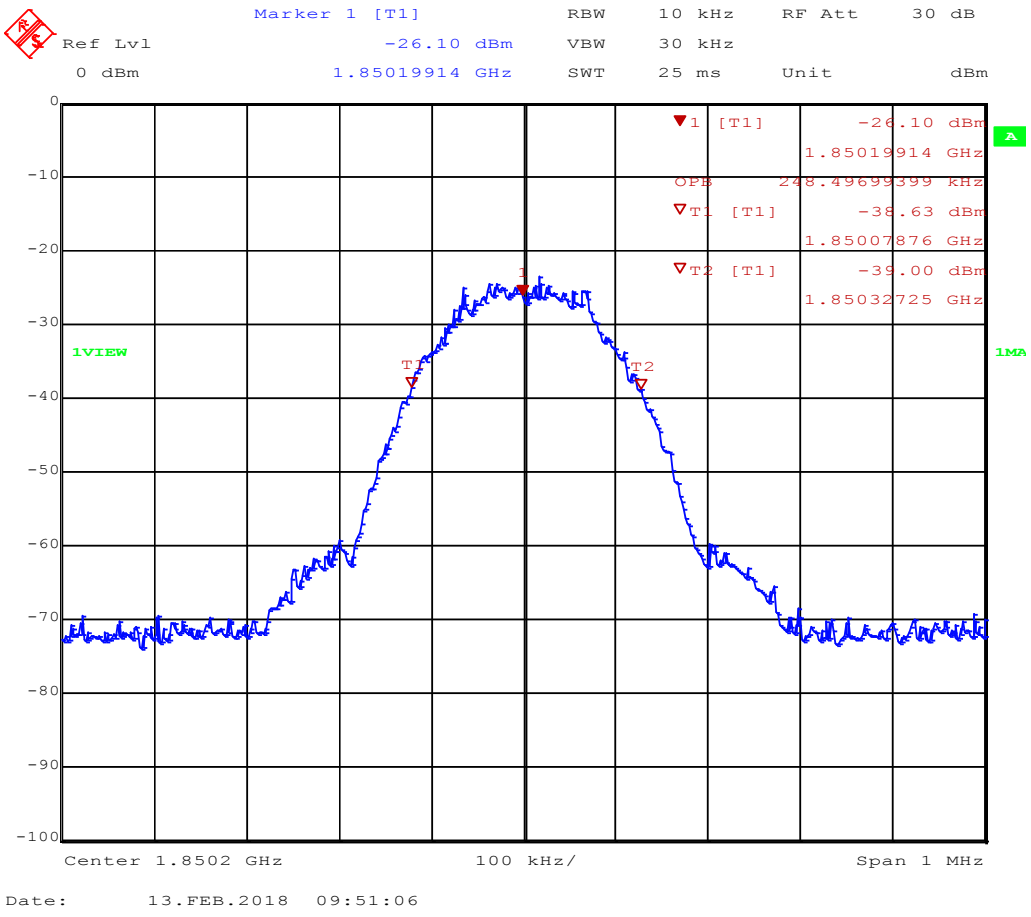
Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 251
Note 2:	Test Mode A



Occupied Bandwidth

Project Number: G0M-1709-6865

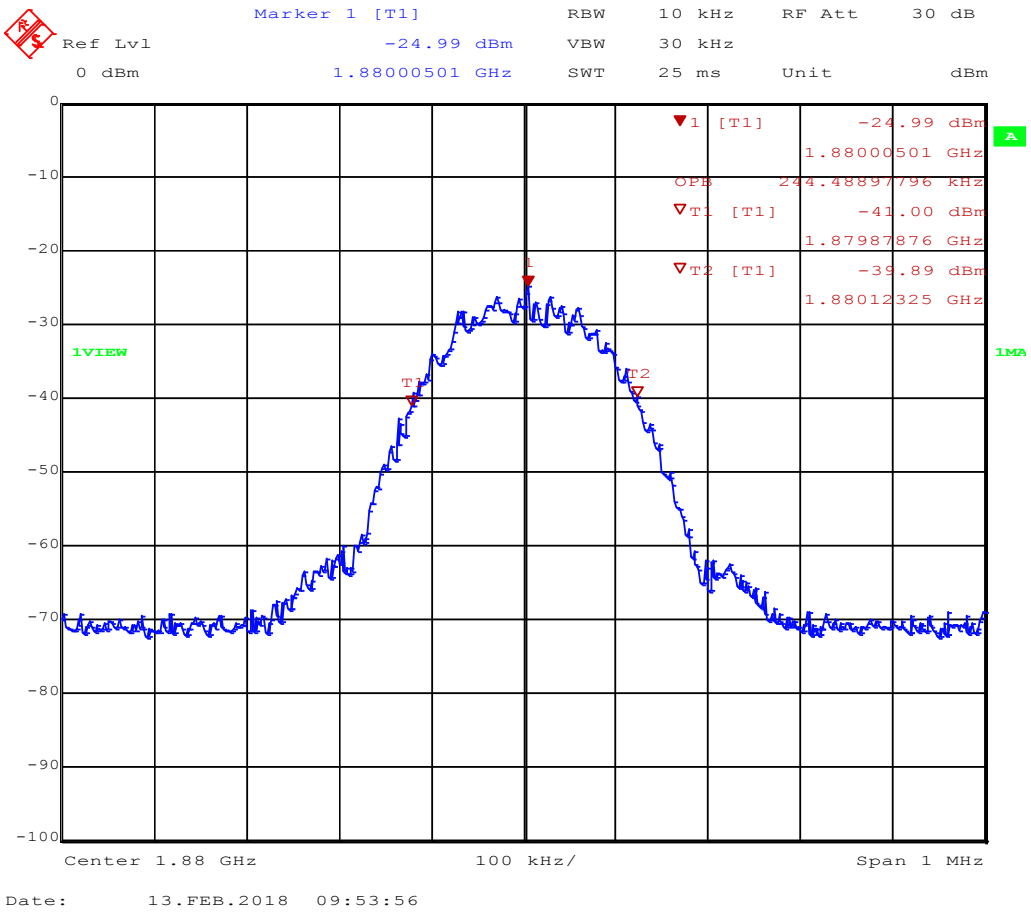
Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 512
Note 2:	Test Mode A



Occupied Bandwidth

Project Number: G0M-1709-6865

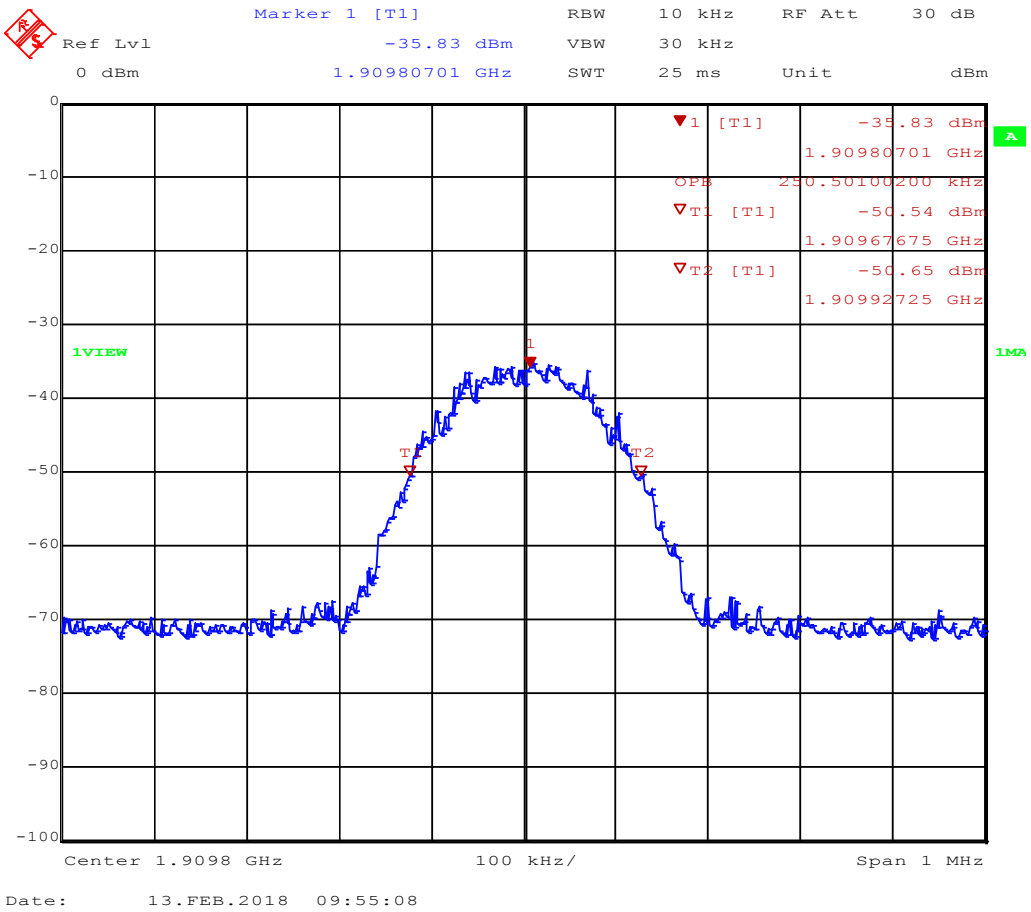
Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 661
Note 2:	Test Mode A



Occupied Bandwidth

Project Number: G0M-1709-6865

Applicant:	ECD Electronic Components GmbH Dresden
EUT Name:	Gateway
Model:	Connect S
Test Site:	Eurofins Product Service GmbH
Operator:	Sebastian Suckow
Test Conditions:	Tnom / Vnom
Mode:	GPRS
Test Date:	2018-02-13
Verdict:	NONE (INFORMATION ONLY)
Note 1:	CH. 810
Note 2:	Test Mode A



3.2 Test Conditions and Results - Effective radiated power / Equivalent isotropic radiated power

3.2.1 Information

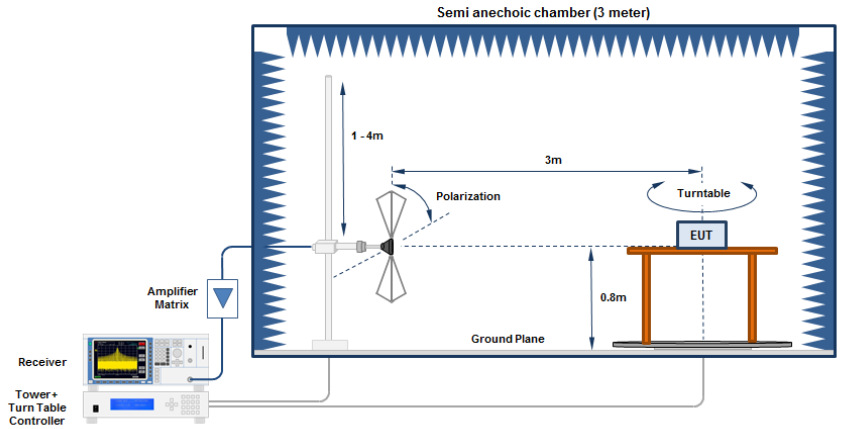
Test Information	
Reference	FCC § 22.913(a) / FCC § 24.232(c) ISED RSS-132 § 4.4 /IC RSS-133 § 6.4
Measurement Method	FCC § 22.913(a) / FCC § 24.232(c) / ANSI/TIA-603-D ISED RSS-132 § 4.4 / ISED RSS-133 § 6.4 / ANSI C63.26-2015 5.2
Operator	Sebastian Suckow
Date	2018-02-12

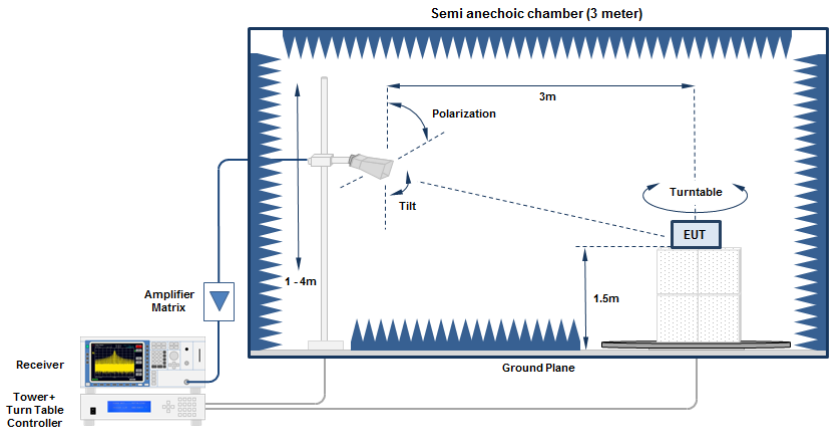
3.2.2 Limits

Limits		
Carrier frequency range [MHz]	Equipment type	Power limit
824 - 849	Mobile transmitter	FCC: 7 Watts (38.45 dBm) e.r.p. ISED: 11.5 Watts (40.60 dBm) e.i.r.p.
1850 - 1910	Mobile transmitter	FCC: 2 Watts (33 dBm) e.i.r.p. ISED: 2 Watts (33dBm) e.i.r.p.

3.2.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz


3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC6	EF00910	-	-
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2017-08	2018-08
Antenna	R&S	HL 223	EF00187	2016-05	2019-05
Antenna	R&S	BBHA 9120D	EF00018	2016-09	2019-09

3.2.5 Procedure

Test Procedure
1. EUT set to test mode 2. The radiated power is measured with a measurement antenna in vertical polarization 3. To obtain maximum level the EUT is rotated 4. The EUT is replaced with a half-wave dipole and the power to the dipole is adjusted to obtain same radiated power measurement value

3.2.6 Results

Test Results - GSM850 E.R.P.						
Frequency [MHz]	Mode	Pol.	Power [dBm e.r.p.]	Limit [dBm e.r.p.]	Margin [dB]	Result
824.2	GPRS	hor	30.0	38.45	-08.45	PASS
836.2	GPRS	hor	30.4	38.45	-08.05	PASS
848.8	GPRS	hor	31.0	38.45	-07.45	PASS
Test Results - GSM850 E.I.R.P.						
Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p.]	Limit [dBm e.i.r.p.]	Margin [dB]	Result
824.2	GPRS	hor	32.2	40.6	-08.40	PASS
836.2	GPRS	hor	32.6	40.6	-08.00	PASS
848.8	GPRS	hor	33.2	40.6	-07.40	PASS

Test Results - GSM1900 E.I.R.P.						
Frequency [MHz]	Mode	Pol.	Power [dBm e.i.r.p.]	Limit [dBm e.i.r.p.]	Margin [dB]	Result
1850.2	GPRS	hor	20.8	33	-12.20	PASS
1880.0	GPRS	hor	19.2	33	-13.80	PASS
1909.8	GPRS	hor	18.6	33	-14.40	PASS

3.3 Test Conditions and Results - Transmitter radiated emissions

3.3.1 Information

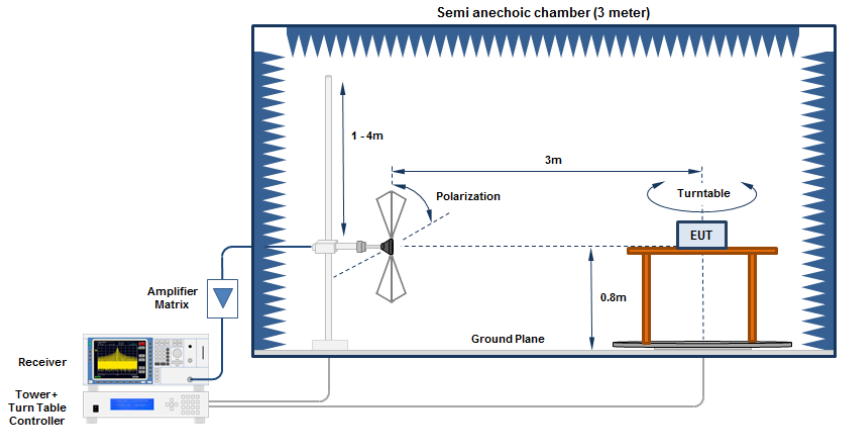
Test Information	
Reference	FCC § 22.917(a) / FCC § 24.238(a) ISED RSS-132 § 4.5 / ISED RSS-133 § 6.5
Measurement Method	ANSI/TIA-603-D / ANSI C63.26-2015 5.5
Operator	Sebastian Suckow
Date	2018-02-12 - 2018-02-15

3.3.2 Limits

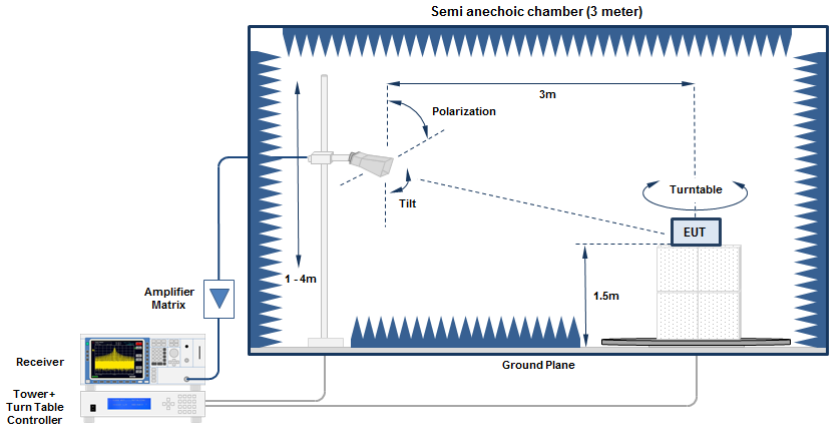
Limits	
Carrier frequency range [MHz]	Limit
824-849	Attenuation below transmitter power ≥ 43 + 10 • log10(P) [dB] = -13 dBm
1850 - 1910	Attenuation below transmitter power ≥ 43 + 10 • log10(P) [dB] = -13 dBm

3.3.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz



3.3.4 Equipment

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC6	EF00910	-	-
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2017-08	2018-08
Antenna	R&S	VULB 9162	EF00978	2016-11	2019-11

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC6	EF00910	-	-
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2017-08	2018-08
Antenna	R&S	BBHA 9120D	EF01153	2017-08	2018-08
Antenna	Amplifier Research	AT4560	EF01152	2017-10	2018-10

3.3.5 Procedure

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

3.3.6 Results

Test Results - GSM850						
Frequency [MHz]	Mode	Emission [MHz]	Level [dBm]	Pol.	Limit [dBm]	Margin [dB]
824.2	GPRS	1648	-34.49	hor	-13	-21.49
824.2	GPRS	1648	-31.79	ver	-13	-18.79
824.2	GPRS	2470	-40.48	hor	-13	-27.48
824.2	GPRS	2470	-40.93	ver	-13	-27.93
824.2	GPRS	3292	-37.93	hor	-13	-24.93
824.2	GPRS	4120	-27.06	hor	-13	-14.06
824.2	GPRS	4120	-37.21	ver	-13	-24.21
848.8	GPRS	1672	-38.42	hor	-13	-25.42
848.8	GPRS	1672	-33.16	ver	-13	-20.16
848.8	GPRS	2506	-41.89	hor	-13	-28.89
848.8	GPRS	3340	-33.77	hor	-13	-20.77
848.8	GPRS	3340	-40.62	ver	-13	-27.62
848.8	GPRS	4176	-24.84	hor	-13	-11.84
848.8	GPRS	4176	-31.09	ver	-13	-18.09
848.8	GPRS	1696	-40.51	hor	-13	-27.51
848.8	GPRS	1696	-36.33	ver	-13	-23.33
848.8	GPRS	2542	-47.00	hor	-13	-34.00
848.8	GPRS	3394	-37.11	hor	-13	-24.11
848.8	GPRS	3394	-42.22	ver	-13	-29.22
848.8	GPRS	4240	-28.22	hor	-13	-15.22
848.8	GPRS	4240	-34.47	ver	-13	-21.47

Test Results - GSM1900						
Frequency [MHz]	Mode	Emission [MHz]	Level [dBm]	Pol.	Limit [dBm]	Margin [dB]
1850.2	GPRS	1850	-27.70	hor	-13	-14.74
1850.2	GPRS	1850	-33.01	ver	-13	-20.01
1880.0	GPRS	3975	-29.75	ver	-13	-16.75
1880.0	GPRS	3983	-29.19	hor	-13	-16.19
1909.8	GPRS	1910	-32.00	hor	-13	-19.00
1909.8	GPRS	1910	-21.45	ver	-13	-08.45

3.4 Test Conditions and Results - Receiver radiated emissions

3.4.1 Information

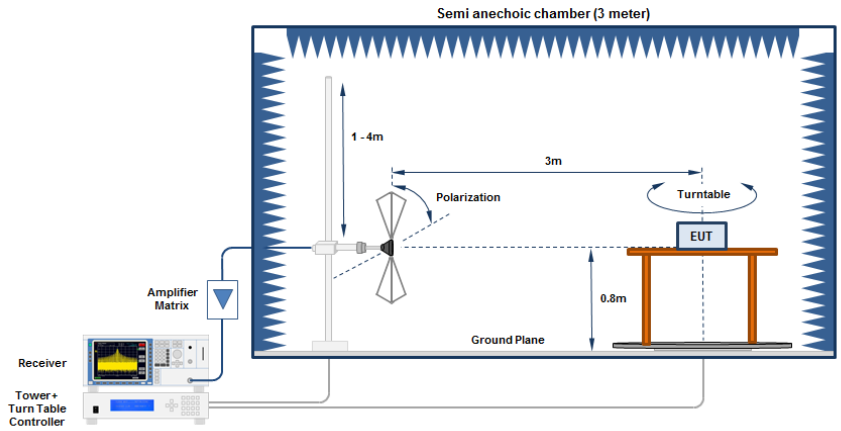
Test Information	
Reference	ISED RSS-132 5.6 / 133 6.6
Measurement Method	ANSI C63.4
Operator	Sebastian Suckow
Date	2018-02-12 - 2018-02-15

3.4.2 Limits

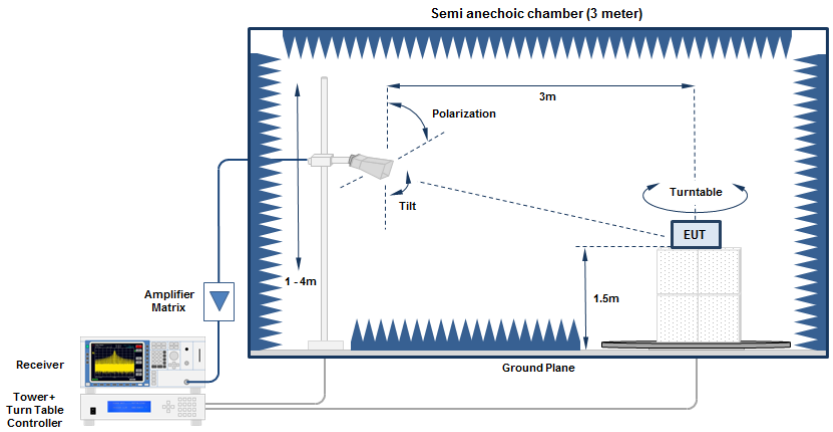
Limits				
Frequency [MHz]	Detector	Limit [µV/m]	Limit [dBµV/m]	Limit Distance [m]
30 - 88	Quasi-Peak	100	40	3
88 - 216	Quasi-Peak	150	43.5	3
216 - 960	Quasi-Peak	200	46	3
960 - 1000	Quasi-Peak	500	54	3
>1000	Average	500	54	3

3.4.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz



3.4.4 Equipment

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC6	EF00910	-	-
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2017-08	2018-08
Antenna	R&S	VULB 9162	EF00978	2016-11	2019-11

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC6	EF00910	-	-
Measurement Receiver	R&S	ESU 26	EF00887	2017-07	2018-07
Measurement Receiver	Agilent	N9038A-526/WXP	EF01070	2017-08	2018-08
Antenna	R&S	BBHA 9120D	EF01153	2017-08	2018-08

3.4.5 Procedure

Test Procedure 30 - 1000 MHz

1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz

1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

3.4.6 Results

Test Results - GSM850						
Frequency [MHz]	Mode	Emission [MHz]	Level [dBµV/m]	Pol.	Limit [dBµV/m]	Margin [dB]
836.2	Idle	7984	50.03	hor	53.98	-03.95
836.2	Idle	7984	49.70	ver	53.98	-04.28

Test Results - GSM1900						
Frequency [MHz]	Mode	Emission [MHz]	Level [dBµV/m]	Pol.	Limit [dBµV/m]	Margin [dB]
1880.0	Idle	1948	44.41	ver	53.98	-09.57
1880.0	Idle	7408	51.05	ver	53.98	-02.93
1880.0	Idle	7840	50.71	hor	53.98	-03.27