

**FCC LISTED, REGISTRATION  
NUMBER: 905266**

**IC LISTED REGISTRATION NUMBER  
IC 4621**

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**TEST REPORT**

**REFERENCE STANDARD: USA FCC Part 22 & Part 24**

<b>NIE</b> ..... :	29081RET.001
Approved by (name / position & signature) .....	A. Llamas / RF Lab. Manager .....
Elaboration date .....	2009-01-26
<b>Identification of item tested</b> .....	GSM/GPRS MODULE
Trademark .....	Telit
Model and/or type reference .....	GE864-QUAD Automotive
Serial number .....	IMEI: 004401910000203
Other identification of the product .....	FCC ID: RI7GE864QA / H/W version 1 / S/W version 07.03.030 SVN=04
Features .....	QUAD BAND GSM/GPRS class 10, DC Voltage from power supply 3.8 Vdc
Description .....	2.5G Wireless Module
<b>Applicant</b> .....	TELIT COMMUNICATIONS S.p.A
Address.....	Via Stazione di Prosecco 5/b / 34010 - Sgonico (Trieste) / ITALY
CIF/NIF/Passport.....	03711600266
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<b>Test samples supplier</b> .....	Same as applicant
<b>Manufacturer</b> .....	Same as applicant

<b>Test method requested</b> .....	See Standard
<b>Standard</b> .....	USA FCC Part 22: Public mobile services USA FCC Part 24: Personal communications services.
<b>Test procedure</b> .....	1. PEET000: Medidas de equipos radioeléctricos en condiciones radiadas. 2. PEET003: Medidas conducidas de equipos radioeléctricos
<b>Non-standardized test method</b> .....	N/A
<b>Used instrumentation</b> .....	1. Semianechoic Absorber Lined Chamber IR 11. BS. 2. Control Chamber IR 12.BC. 3. Hybrid Bilog antenna Sunol Sciences Corporation JB6. 4. Antenna tripod EMCO 11968C. 5. Antenna mast EM 1072 NMT. 6. Rotating table EM 1084-4. ON. 7. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E. 8. RF pre-amplifier Miteq AFS5-04001300-15-10P-6. 9. EMI Test Receiver R&S ESIB26. 10. Universal Radio communication Tester R&S CMU200. 11. Multi Device Controller EMCO 2090. 12. Spectrum Analyzer R&S ESU40. 13. Spectrum Analyzer Agilent E4440A. 14. Power amplifier ENI 603L-1471. 15. Log-Periodic antenna R&S HL 040. 16. RF generator Agilent ESG E4438C. 17. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J. 18. RF pre-amplifier Miteq JS4-12002600-30-5A.
<b>Report template No.</b> .....	FDT08_11
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### **Competences and guarantees**

AT4 wireless, S.A. is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

AT4 wireless, S.A. is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621.

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 AT4 wireless internal document PODT000.

### Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
27913/02	GSM Module	GE864-QUAD Automotive	IMEI: 004401910000203	28/04/2008
27334/05	Evaluation board	---	---	03/03/2008
--	Antenna	--	---	--

1. Sample M/01 has undergone the test(s) specified in subclause "Test method requested".

### Testing period

The performed test started on 2009-01-12 and finished on 2009-01-20.

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. = 21 °C Max. = 22 °C
Relative humidity	Min. = 58 % Max. = 59 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k $\Omega$
Reference resistance to earth	< 0,5 $\Omega$

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

Temperature	Min. = 21 °C Max. = 22 °C
Relative humidity	Min. = 58 % Max. = 59 %
Air pressure	Min. = 1006 mbar Max. = 1006 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k $\Omega$
Reference resistance to earth	< 0,5 $\Omega$
Normal site attenuation (NSA)	< $\pm$ 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. = 22 °C Max. = 23 °C
Relative humidity	Min. = 51 % Max. = 52 %
Air pressure	Min. = 1010 mbar Max. = 1010 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k $\Omega$
Reference resistance to earth	< 0,5 $\Omega$

**Summary**

Considering the results of the performed test according to standards USA FCC Part 22 and part 24, the item under test is **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**

None.

**Testing verdicts**

Not applicable .....: NA  
 Pass.....: P  
 Fail .....: F  
 Not measured.....: NM

FCC PART 22 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 22.913: RF output power		P		
Clause 2.1055: Frequency stability		P		
Clause 22.917: Spurious emissions at antenna terminals		P		
Clause 22.917: Radiated emissions		P		

FCC PART 24 PARAGRAPH	VERDICT			
	NA	P	F	NM
Clause 24.232: RF output power		P		
Clause 24.235: Frequency stability		P		
Clause 24.238: Spurious emissions at antenna terminals		P		
Clause 24.238: Radiated emissions		P		

## **APPENDIX A: Test results**



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## TEST RESULTS FOR FCC PART 22

### ***TEST CONDITIONS***

Power supply (V):

$$V_{\text{nom}} = 3.8 \text{ Vdc}$$

$$V_{\text{max}} = 4.2 \text{ Vdc}$$

$$V_{\text{min}} = 3.4 \text{ Vdc}$$

The subscripts nom, min and max indicate voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = External connectable antenna

TEST FREQUENCIES:

Lowest channel (128): 824.2 MHz

Middle channel (190): 836.6 MHz

Highest channel (251): 848.8 MHz

## ***RF Output Power (conducted and E.R.P.)***

### SPECIFICATION

§2.1046 and 22.913.

The Effective Radiated Power (E.R.P.) of mobile transmitter and auxiliary test transmitter must not exceed 7 Watts (38.45 dBm).

### METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

For radiated measurements the EUT was placed on a 1 m high non-conductive stand inside an anechoic chamber. The measuring antenna was placed at 3 m distance and the maximum field strength was measured for the three channels. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

The Effective Radiated Power (E.R.P.) is obtained by using the Substitution Method according to ANSI/TIA/EIA-603-C: 2004.

### RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED). See plots in next pages.

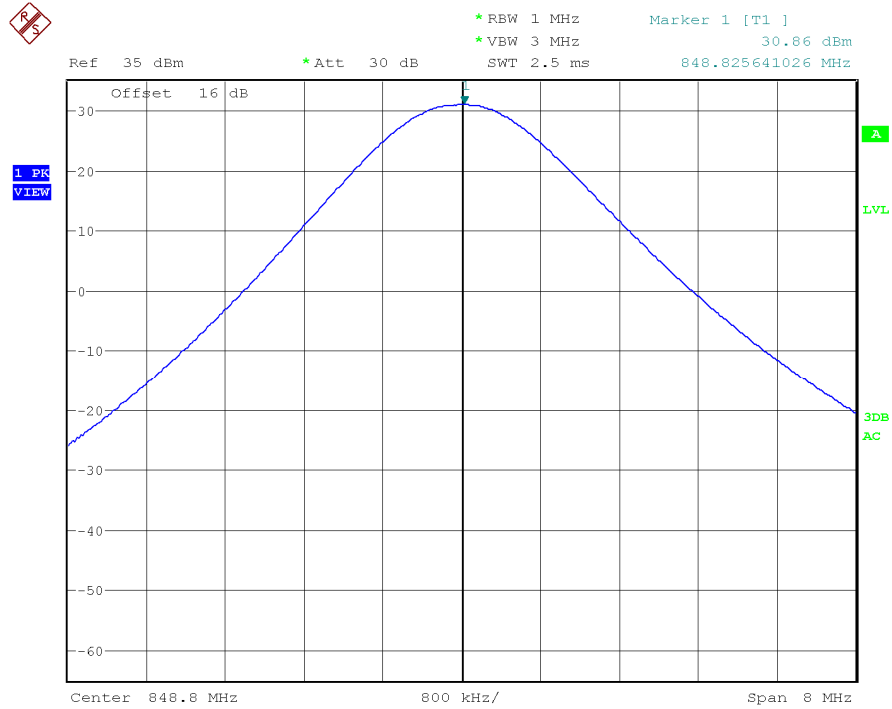
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	30.22	30.45	30.86
Maximum peak power (W)	1.05	1.11	1.22
Measurement uncertainty (dB)	±1.5		

Verdict: PASS



PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 848.8 MHz.



MAXIMUM EFFECTIVE RADIATED POWER E.R.P. (RADIATED).

Substitution method data

Frequency (MHz) at max. reading	Max. Instrument reading (dBm)	Polarization	(1) RF Generator +power amplifier output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gd (respect to $\lambda/2$ dipole) (dB)	E.R.P. (dBm) = (1) – (2) + (3)
824.234	-14.80	Vertical	22.70	0.3	6.3	28.70
836.631	-16.86	Vertical	21.24	0.3	6.2	27.14
848.819	-18.06	Vertical	20.04	0.3	6.1	25.84

Channel	Lowest	Middle	Highest
Maximum peak power E.R.P. (dBm)	28.70	27.14	25.84
Maximum peak power (W)	0.74	0.52	0.38
Measurement uncertainty (dB)	± 3.8		

Verdict: PASS

## Modulation Characteristics

### SPECIFICATION

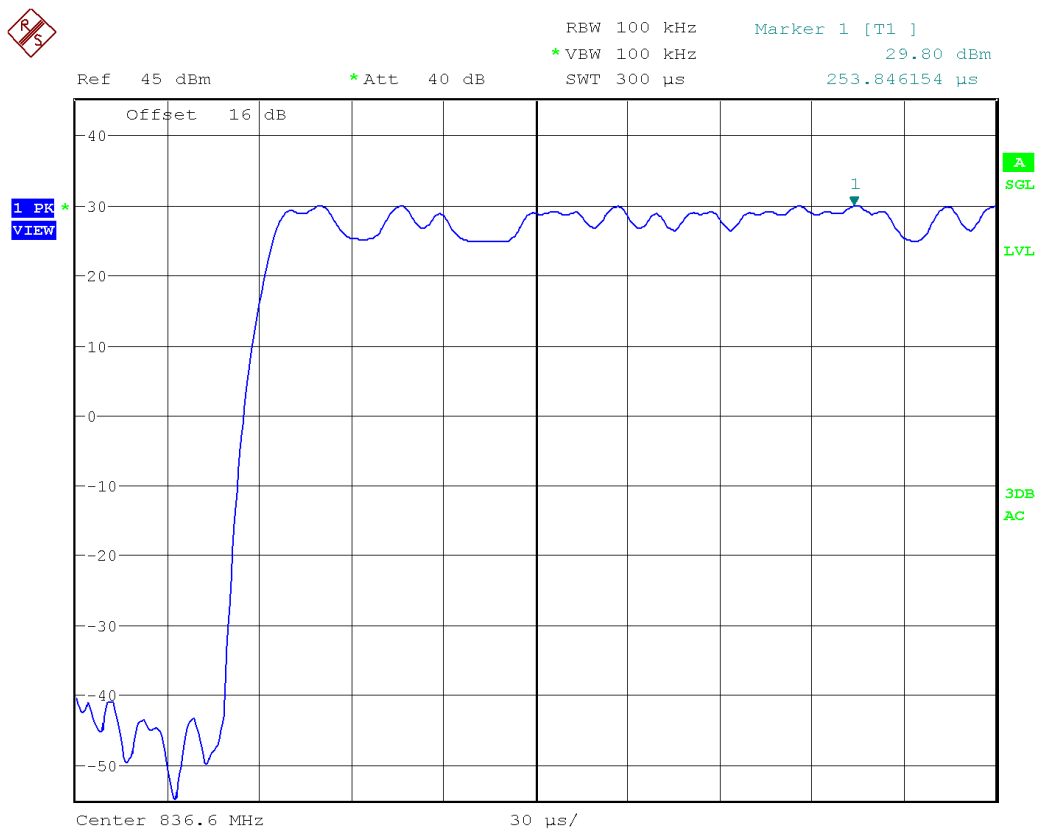
§2.1047

### METHOD

The EUT uses GMSK modulation, in which voice or data information is digitized and coded into a bit stream. The bits are conveyed through precise phase changes in the carrier.

### RESULTS

The following plot shows the modulation scheme (GMSK) in the EUT.



## *Frequency Stability*

### SPECIFICATION

§2.1055

### METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The EUT was placed inside a climatic chamber and the temperature was raised hourly in  $10^{\circ}\text{C}$  steps from  $-30^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$ .

The frequency tolerance measurements over voltage variations were made at room temperature and at the  $V_{\text{max}}$  and  $V_{\text{min}}$  supply voltages as declared by the applicant.

The EUT was set in “call mode” in the middle channel 190 (836.6 MHz) using the Universal Radio Communication tester R&S CMU200, and the maximum frequency error was measured using the frequency meter of CMU200.

### RESULTS

Frequency stability over temperature variations.

<b>Temperature (<math>^{\circ}\text{C}</math>)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (ppm)</b>	<b>Frequency Error (%)</b>
+50	-5	-0.0060	-0.00000060
+40	-4	-0.0048	-0.00000048
+30	-4	-0.0048	-0.00000048
+20	-2	-0.0024	-0.00000024
+10	-1	-0.0012	-0.00000012
0	-1	-0.0012	-0.00000012
-10	1	0.0012	0.00000012
-20	1	0.0012	0.00000012
-30	2	0.0024	0.00000024



Frequency stability over voltage variations.

<b>Power Supply voltage</b>	<b>Voltage (V)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (ppm)</b>	<b>Frequency Error (%)</b>
Vmax	4.2	-5	-0.0060	-0.00000060
Vmin	3.4	-9	-0.0108	-0.00000108

## *Occupied Bandwidth*

### SPECIFICATION

§2.1049

### METHOD

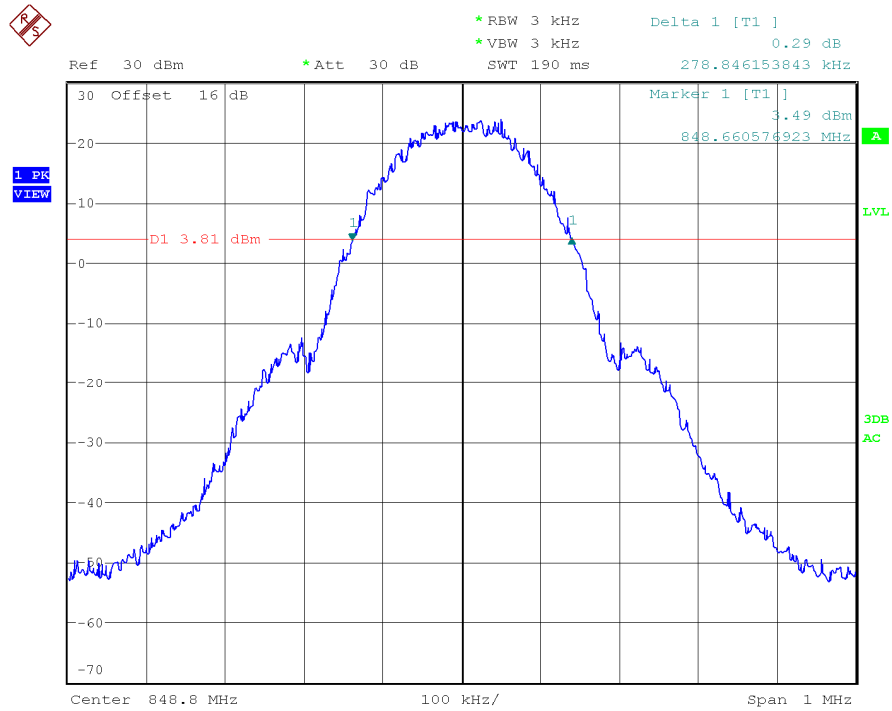
The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 3 kHz was used to determine the occupied bandwidth of the modulated emission.

### RESULTS

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	288.5	283.6	278.8
-26 dBc bandwidth (kHz)	317.3	317.3	317.3
Measurement uncertainty (Hz)	<±40		

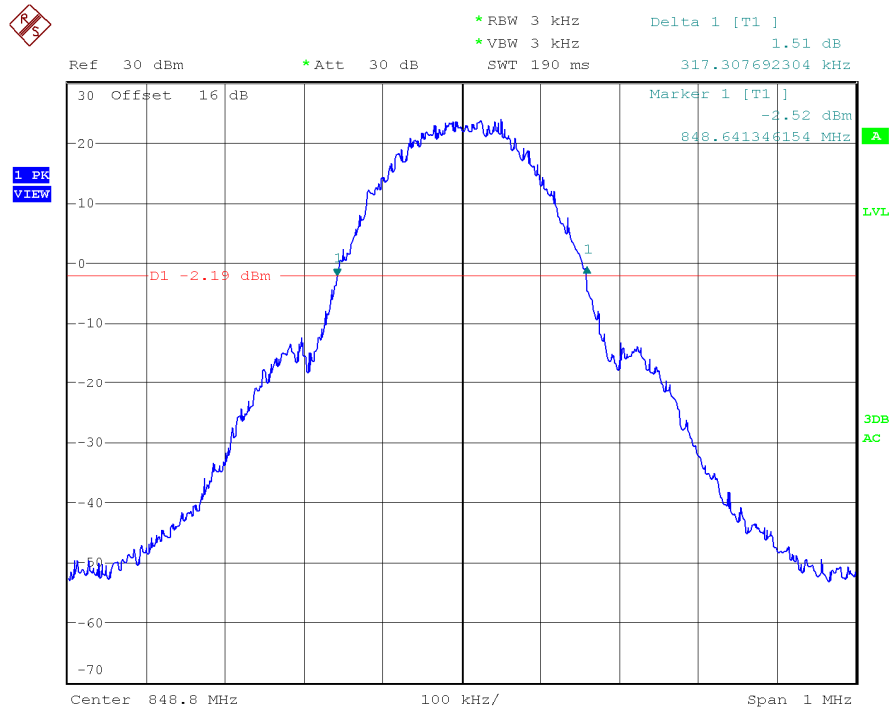


Highest Channel: 848.8 MHz.





Highest Channel: 848.8 MHz.



## *Spurious emissions at antenna terminals*

### SPECIFICATION

§2.1051 and §22.917

### METHOD

The EUT RF output connector was connected to a spectrum analyser using an 50 ohm attenuator and the resolution bandwidth of the spectrum analyser was set to 100 kHz. The spectrum was investigated from 30 MHz to 10 GHz.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

### RESULTS (see plots in next pages)

1. CHANNEL: LOWEST (824.2 MHz).

No spurious signals were found in all the range.

2. CHANNEL: MIDDLE (836.6 MHz).

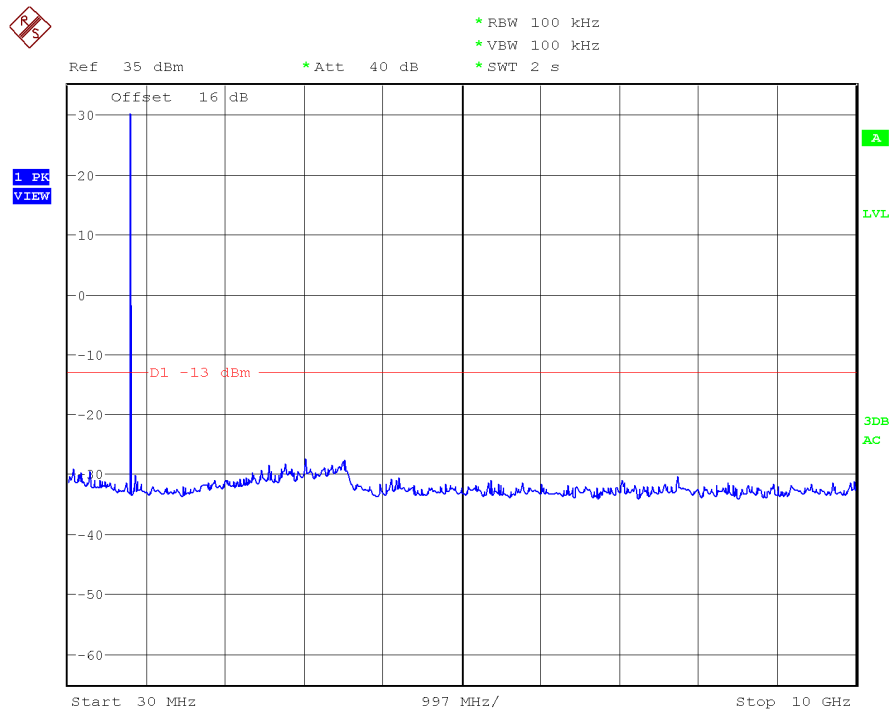
No spurious signals were found in all the range.

3. CHANNEL: HIGHEST (848.8 MHz).

No spurious signals were found in all the range.

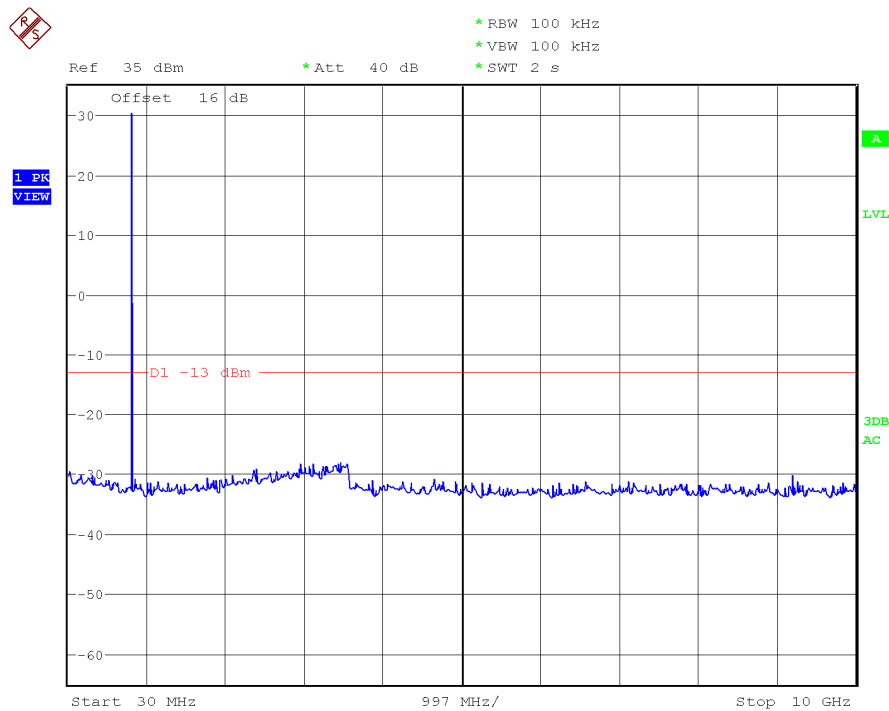
Verdict: PASS

1. CHANNEL: LOWEST (824.2 MHz).



Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE (836.6 MHz).



Note: The peak above the limit is the carrier frequency.





## *Spurious emissions at antenna terminals at Block Edges*

### SPECIFICATION

§2.1051 and §22.917

### METHOD

As indicated in FCC part 22, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A resolution bandwidth of 5 kHz was used.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

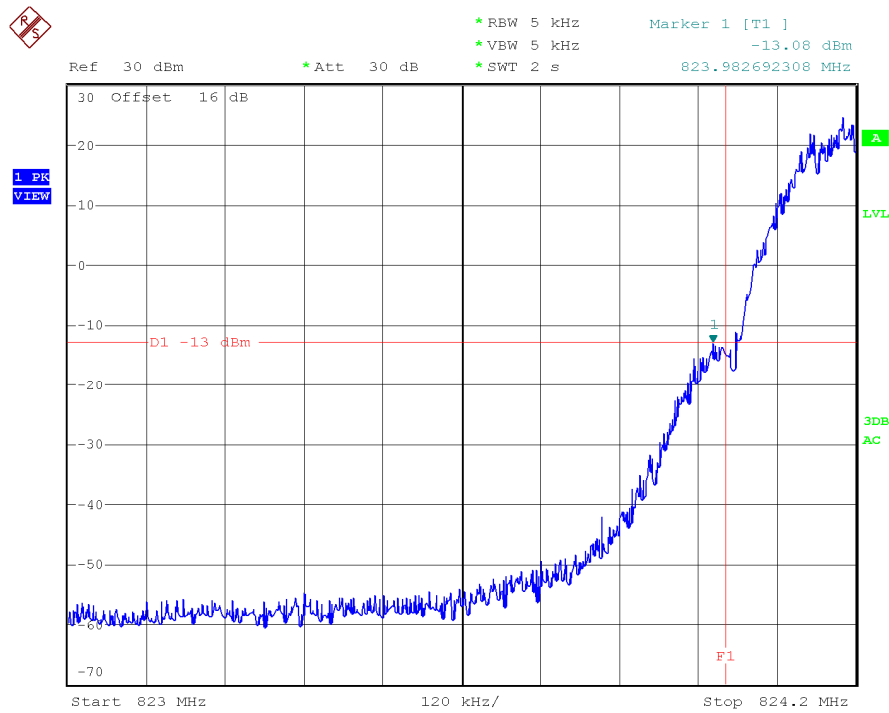
At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

### RESULTS (see plots in next pages)

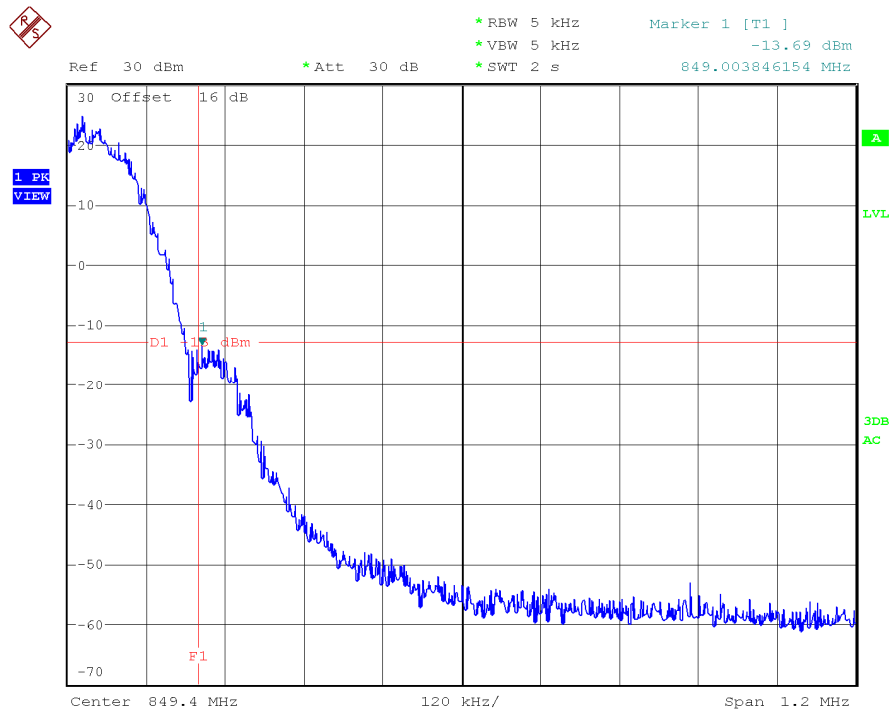
BLOCK	Maximum level at Block Edges (dBm)
A	-13.08
B	-13.69

BLOCK A. CHANNEL LOWEST (824.2 MHz).



NOTE: The equipment transmits at the maximum output power (PCL= 5).

BLOCK B. CHANNEL HIGHEST (848.8 MHz).



NOTE: The equipment transmits at the maximum output power (PCL= 5).

Verdict: PASS

## *Radiated emissions*

### SPECIFICATION

§ 22.917

### METHOD

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded. The radiated emissions were measured with peak detector and 1 MHz bandwidth.

Each detected emissions were substituted by the Substitution method, in accordance with the ANSI/TIA/EIA-603-C: 2004.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

## RESULTS

1. CHANNEL: LOWEST (824.2MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-12.75 GHz.**

Substitution method data

Frequency (MHz) at max. reading	Max. Instrument reading (dBm)	Polarization	(1) RF Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gd (respect to $\lambda/2$ dipole) (dB)	E.R.P. (dBm) = (1) – (2) + (3)
1648.4936	-27.45	Vertical	-33.01	1.9	6.1	-28.81
2472.8846	-30.14	Vertical	-35.94	2.2	7.0	-31.14

2. CHANNEL: MIDDLE (836.6 MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-12.75 GHz.**

Substitution method data

Frequency (MHz) at max. reading	Max. Instrument reading (dBm)	Polarization	(1) RF Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gd (respect to $\lambda/2$ dipole) (dB)	E.R.P. (dBm) = (1) – (2) + (3)
1673.0449	-26.87	Vertical	-31.41	1.9	6.1	-27.21

3. CHANNEL: HIGHEST (848.8 MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-12.75 GHz.**

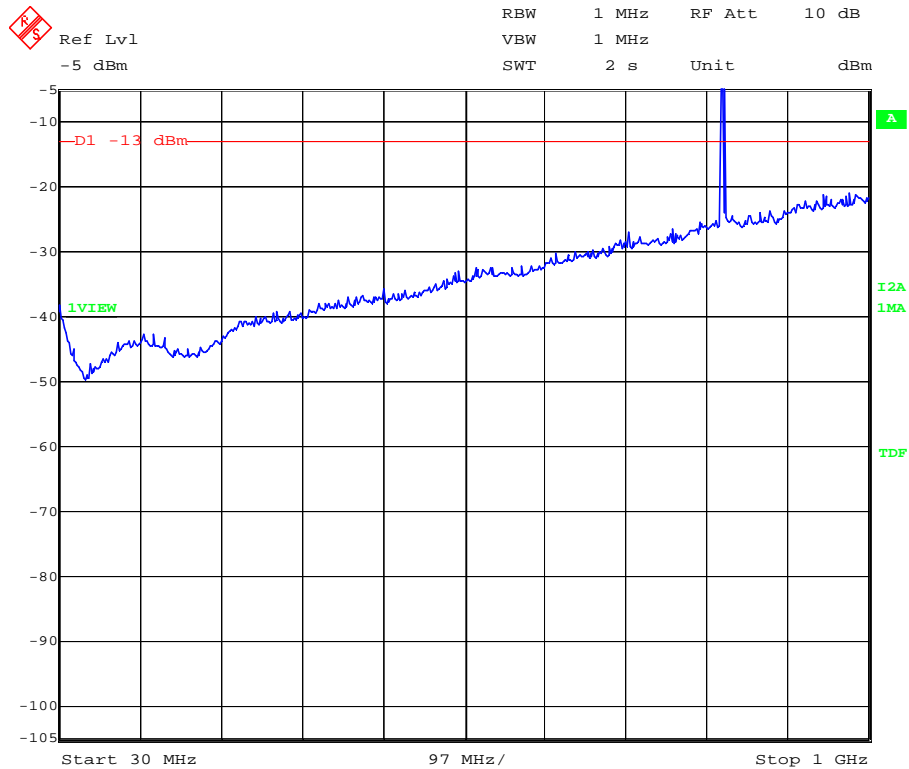
Substitution method data

Frequency (MHz) at max. reading	Max. Instrument reading (dBm)	Polarization	(1) RF Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gd (respect to $\lambda/2$ dipole) (dB)	E.R.P. (dBm) = (1) – (2) + (3)
1697.6602	-28.12	Vertical	-33.45	1.9	6.1	-29.25
2546.2019	-31.23	Vertical	-37.88	2.2	7.0	-33.08

Verdict: PASS

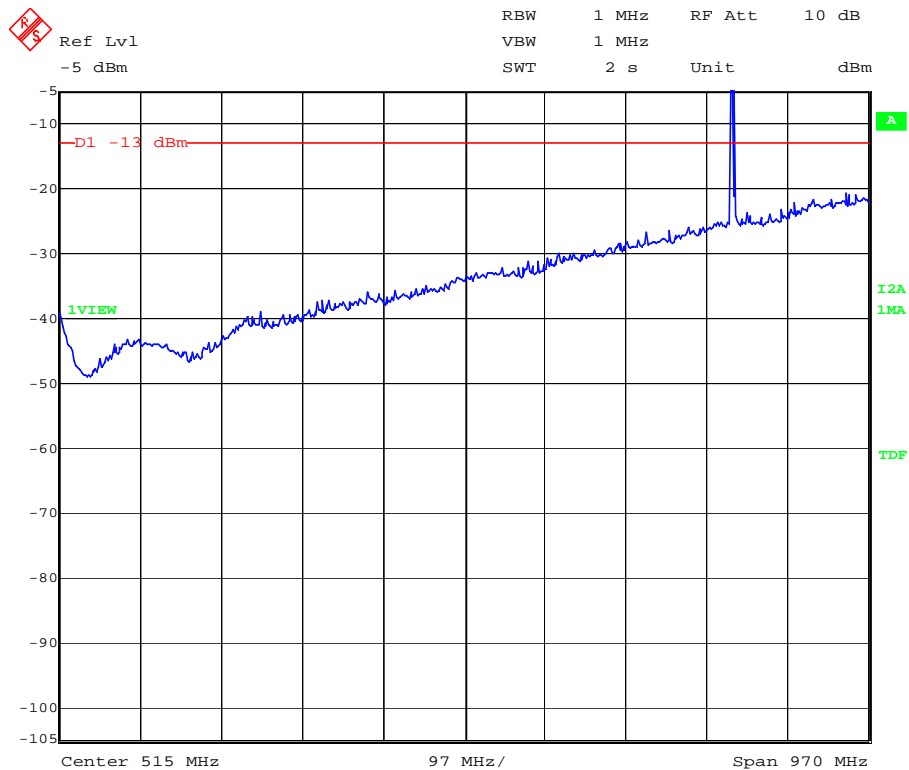
FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: LOWEST (824.2 MHz)



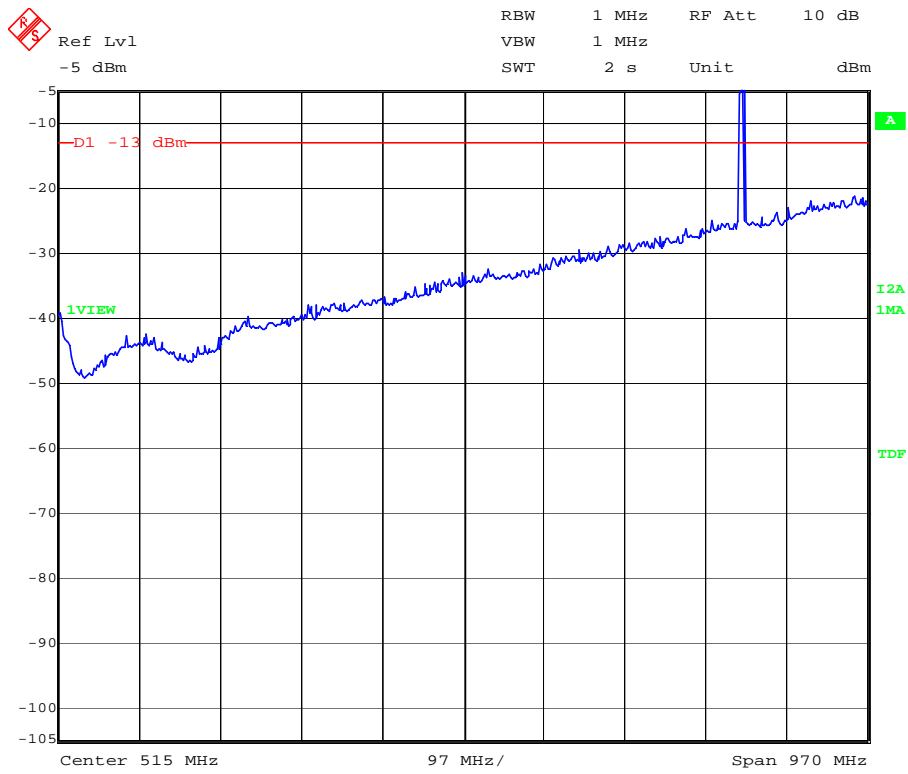
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE (836.6 MHz)



Note: The peak above the limit is the carrier frequency.

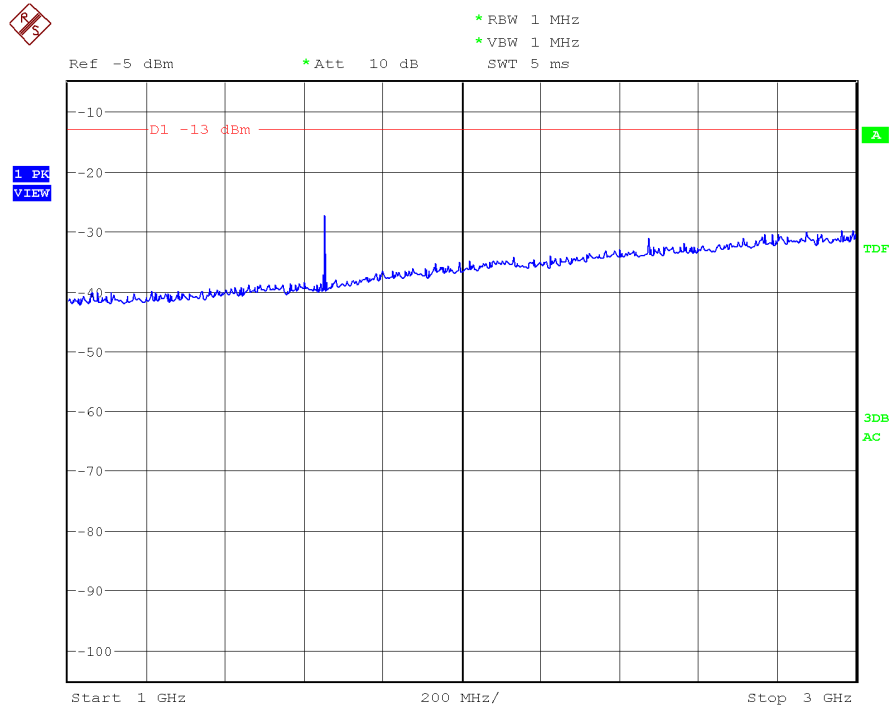
CHANNEL: HIGHEST (848.8 MHz)



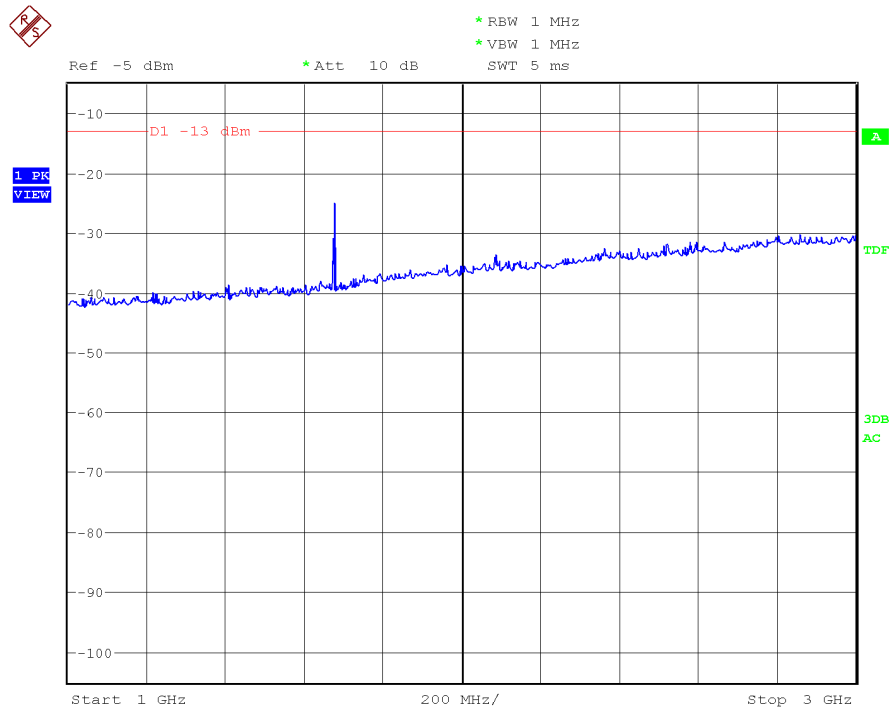
Note: The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST (824.2 MHz)



CHANNEL: MIDDLE (836.6 MHz)







## TEST RESULTS FOR FCC PART 24

### ***TEST CONDITIONS***

Power supply (V):

$$V_{\text{nom}} = 3.8 \text{ Vdc}$$

$$V_{\text{max}} = 4.2 \text{ Vdc}$$

$$V_{\text{min}} = 3.4 \text{ Vdc}$$

The subscripts nom, min and max indicates voltage test conditions (nominal, minimum and maximum respectively, as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = External connectable antenna

### TEST FREQUENCIES:

Lowest channel (512): 1850.2 MHz

Middle channel (662): 1880.2 MHz

Highest channel (810): 1909.8 MHz

## ***RF Output Power (conducted and E.I.R.P.)***

### SPECIFICATION

§2.1046 and 24.232

Mobile/portable stations are limited to 2 Watts (33 dBm) Effective Isotropic Radiated Power (E.I.R.P.) peak power.

### METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

For radiated measurements the EUT was placed on a 1 m high non-conductive stand inside an anechoic chamber. The measuring antenna was placed at 1 m distance and the maximum field strength was measured for the three channels. The EUT was controlled via the Universal Radio Communication tester R&S CMU200 selecting maximum transmission power of the EUT and GMSK modulated signal.

The Effective Isotropic Radiated Power (E.I.R.P.) is obtained by using the Substitution Method according to ANSI/TIA/EIA-603-C: 2004.

### RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED). See plots in next pages.

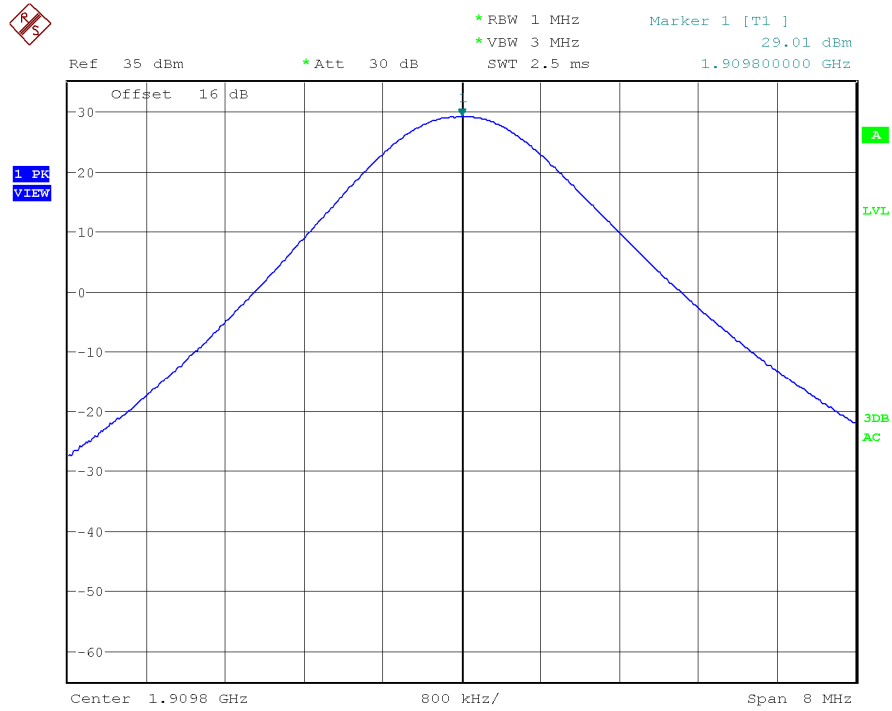
Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	29.88	29.09	29.01
Maximum peak power (W)	0.97	0.81	0.80
Measurement uncertainty (dB)	±1.5		

Verdict: PASS



PEAK OUTPUT POWER (CONDUCTED).

Highest Channel: 1909.8 MHz.



MAXIMUM EQUIVALENT ISOTROPIC RADIATED POWER E.I.R.P. (RADIATED).

Substitution method data

Frequency (MHz) at max. reading	Max. Instrument reading (dBm)	Polarization	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain $G_i$ (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1850.211	-9.30	Vertical	15.10	0.5	8.6	23.20
1880.239	-10.42	Vertical	14.48	0.5	8.3	22.28
1909.788	-10.40	Vertical	14.90	0.5	8.0	22.40

Channel	Lowest	Middle	Highest
Maximum peak power (dBm)	23.20	22.28	22.40
Maximum peak power (W)	0.21	0.17	0.17
Measurement uncertainty (dB)	± 4.0		

Verdict: PASS

## Modulation Characteristics

### SPECIFICATION

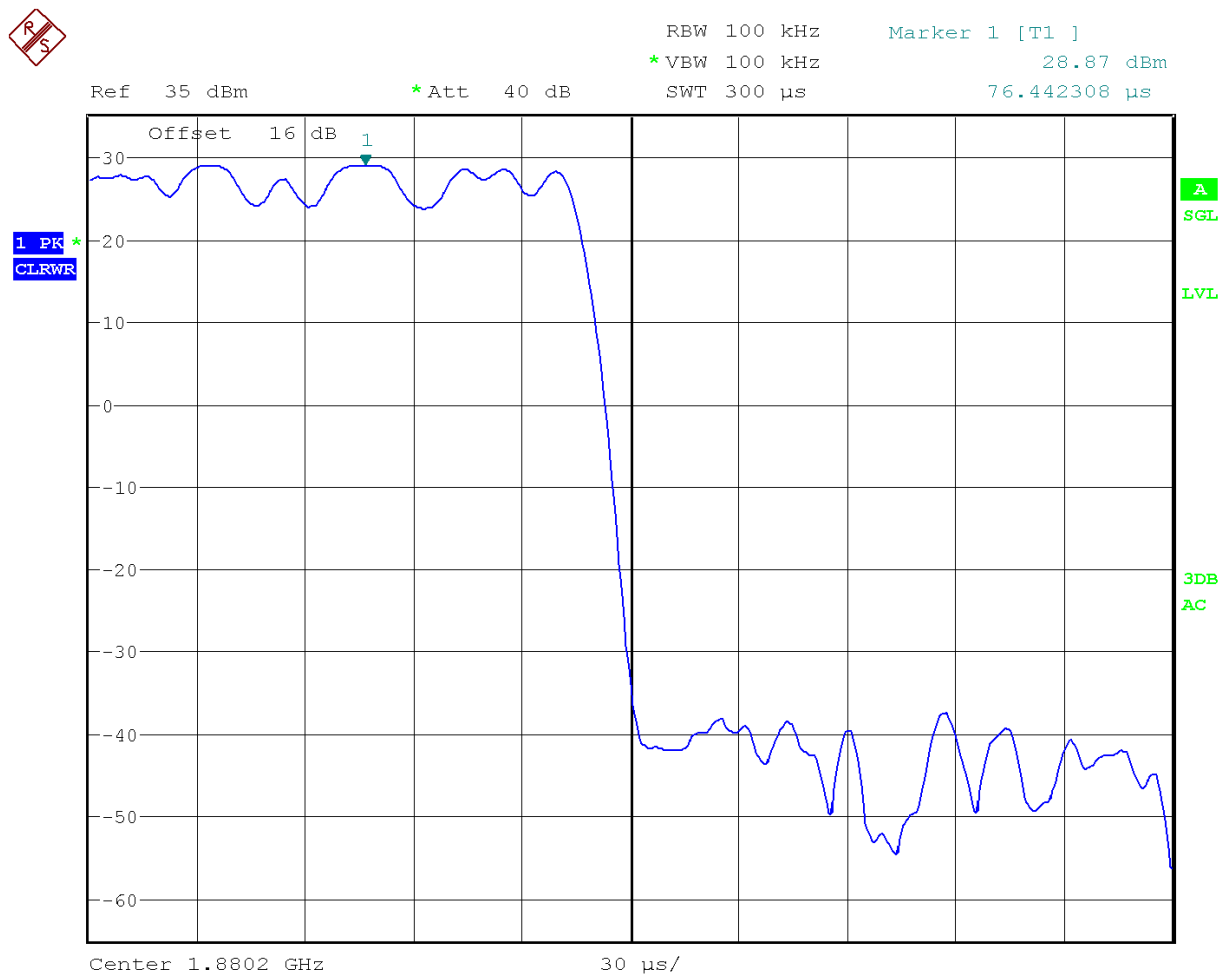
§2.1047

### METHOD

The EUT uses GMSK modulation, in which voice or data information is digitized and coded into a bit stream. The bits are conveyed through precise phase changes in the carrier.

### RESULTS

The following plot shows the modulation scheme (GMSK) in the EUT.



## *Frequency Stability*

### SPECIFICATION

§2.1055 and 24.235

### METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The EUT was placed inside a climatic chamber and the temperature was raised hourly in  $10^{\circ}\text{C}$  steps from  $-30^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$ .

The frequency tolerance measurements over voltage variations were made at room temperature and at the  $V_{\text{max}}$  and  $V_{\text{min}}$  supply voltages as declared by the applicant.

The EUT was set in “call mode” in the middle channel 662 (1880.2 MHz) using the Universal Radio Communication tester R&S CMU200, and the maximum frequency error was measured using the frequency meter of CMU200.

### RESULTS

Frequency stability over temperature variations.

<b>Temperature (<math>^{\circ}\text{C}</math>)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (ppm)</b>	<b>Frequency Error (%)</b>
+50	-3	-0.0016	-0.00000016
+40	-1	-0.0005	-0.00000005
+30	-1	-0.0005	-0.00000005
+20	-1	-0.0005	-0.00000005
+10	3	0.0016	0.00000016
0	3	0.0016	0.00000016
-10	3	0.0016	0.00000016
-20	2	0.0011	0.00000011
-30	2	0.0011	0.00000011



Frequency stability over voltage variations.

<b>Power Supply voltage</b>	<b>Voltage (V)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (ppm)</b>	<b>Frequency Error (%)</b>
Vmax	4.2	-20	-0.0106	-0.00000106
Vmin	3.4	-3	-0.0016	-0.00000016

## *Occupied Bandwidth*

### SPECIFICATION

§2.1049

### METHOD

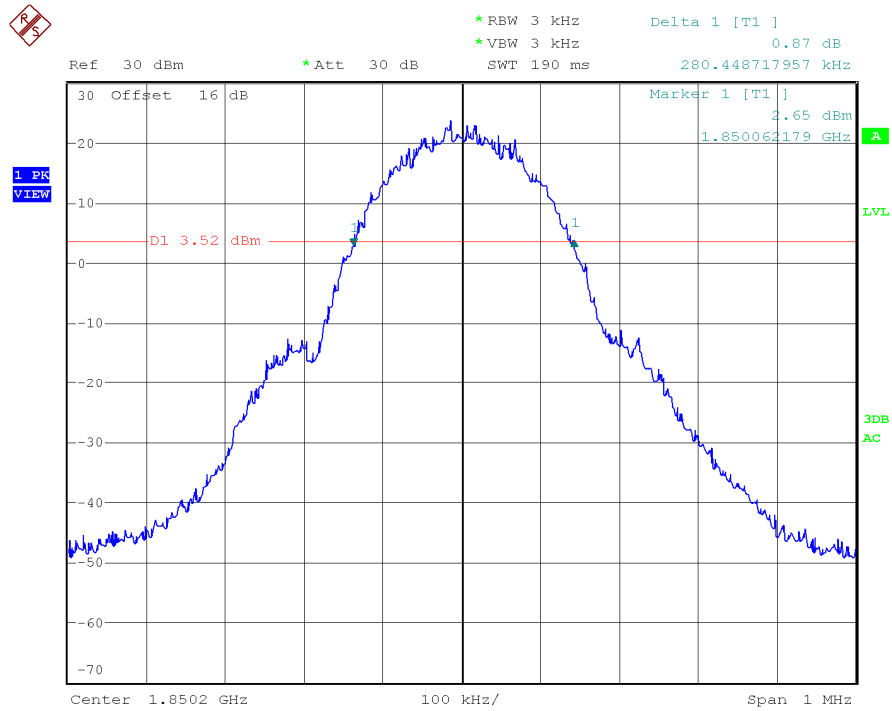
The EUT was configured to transmit a GMSK modulated carrier signal. An IF bandwidth of 3 kHz was used to determine the occupied bandwidth of the modulated emission.

### RESULTS

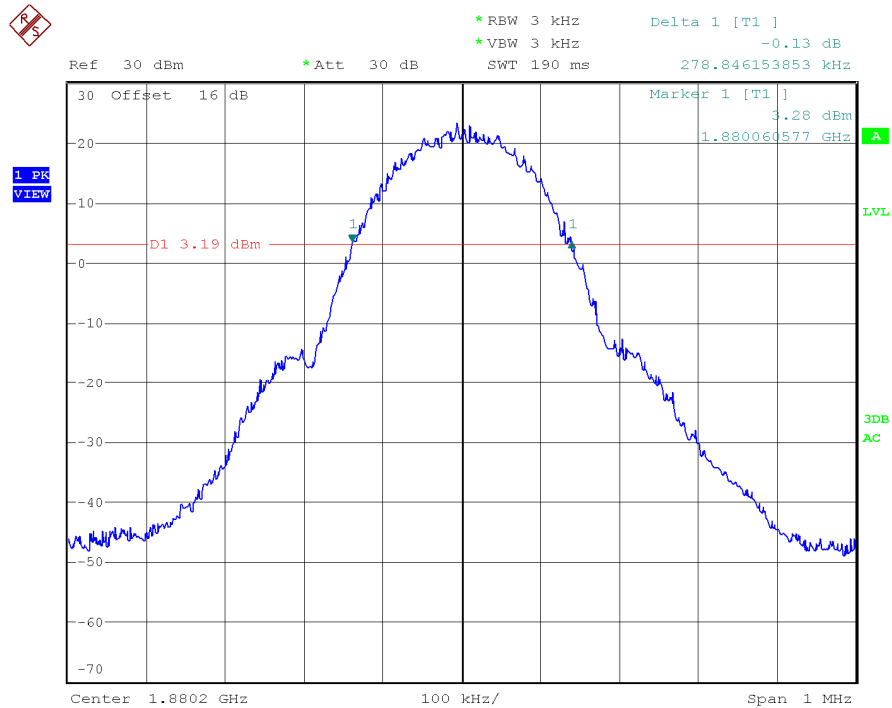
Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	280.4	278.8	277.2
-26 dBc bandwidth (kHz)	315.7	315.7	317.3
Measurement uncertainty (Hz)	<±40		

99% OCCUPIED BANDWIDTH

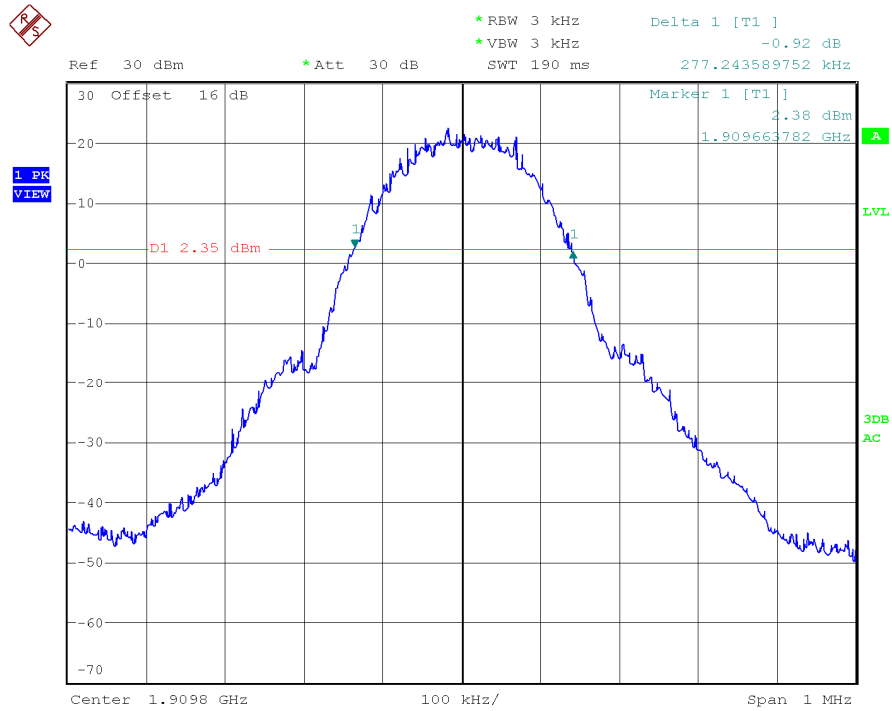
Lowest Channel: 1850.2 MHz.



Middle Channel: 1880.2 MHz.

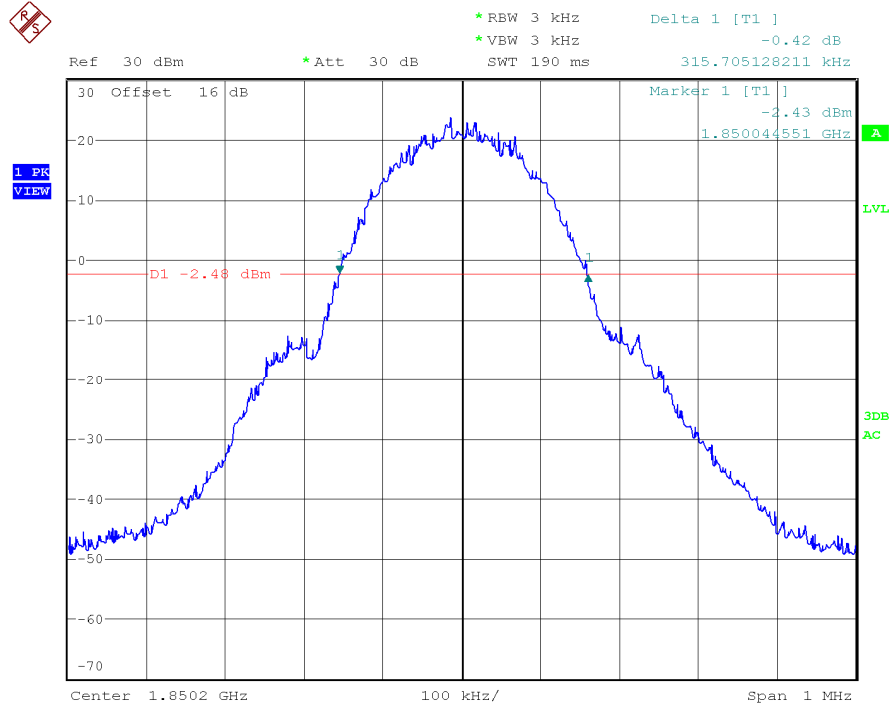


Highest Channel: 1909.8 MHz.

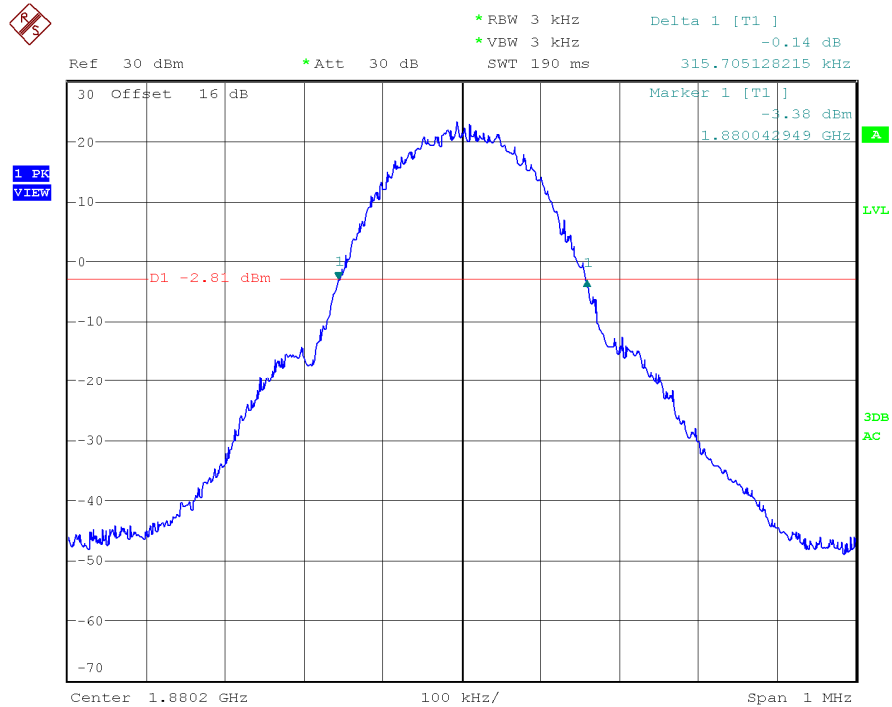


**-26 dBc BANDWIDTH**

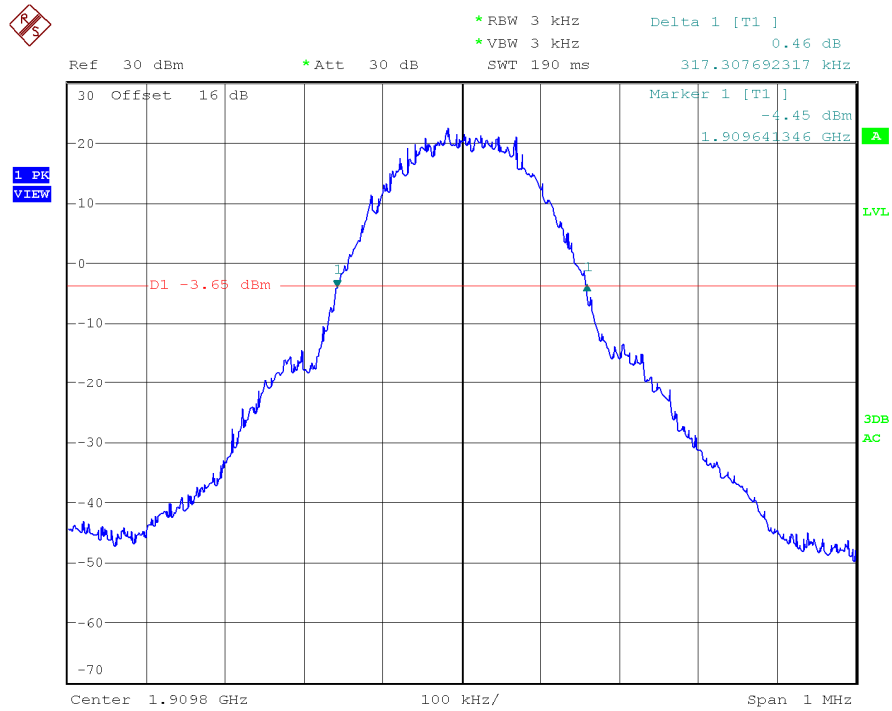
Lowest Channel: 1850.2 MHz.



Middle Channel: 1880.2 MHz.



Highest Channel: 1909.8 MHz.



## *Spurious emissions at antenna terminals*

### SPECIFICATION

§2.1051 and §24.238

### METHOD

The EUT RF output connector was connected to an spectrum analyser using an 50 ohm attenuator and the resolution bandwidth of the spectrum analyser was set to 1 MHz. The spectrum was investigated from 30 MHz to 20 GHz.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

### RESULTS (see plots in next pages)

1. CHANNEL: LOWEST (1850.2 MHz).

No spurious signals were found in all the range.

2. CHANNEL: MIDDLE (1880.2 MHz).

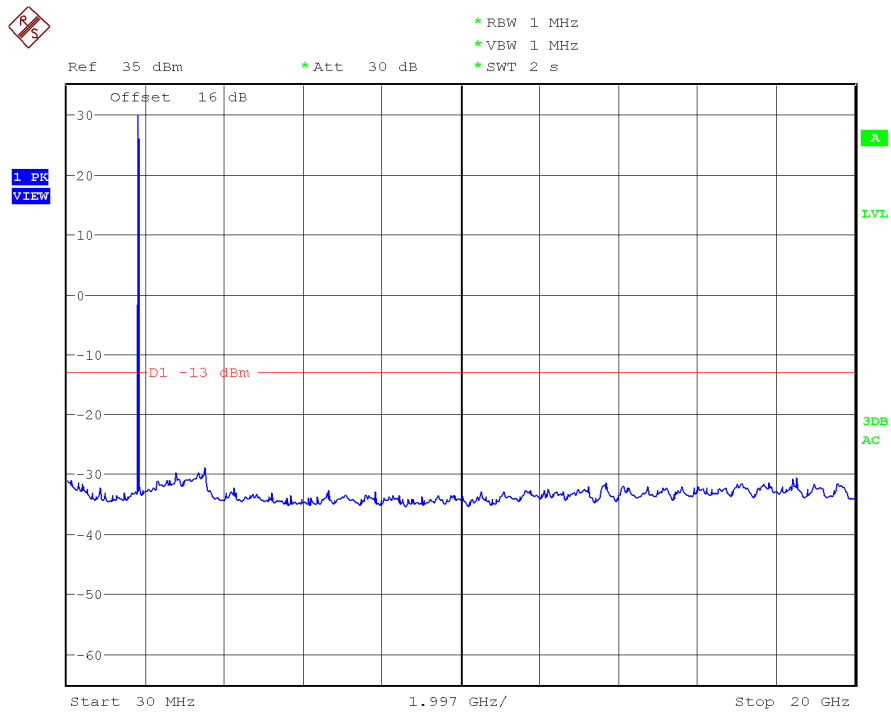
No spurious signals were found in all the range.

3. CHANNEL: HIGHEST (1909.8 MHz).

No spurious signals were found in all the range.

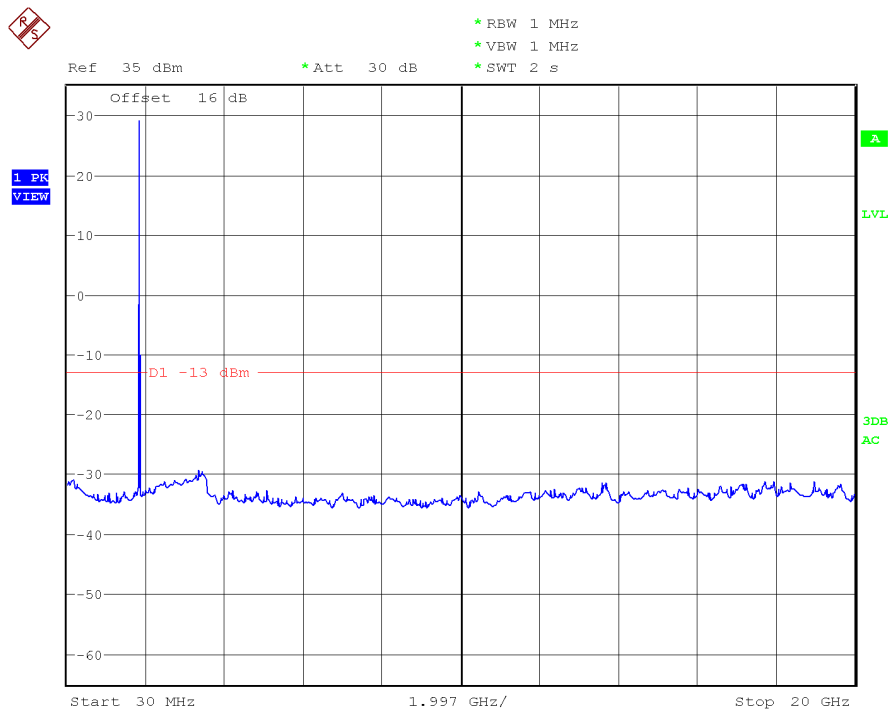
Verdict: PASS

1. CHANNEL: LOWEST (1850.2 MHz).



Note: The peak above the limit is the carrier frequency.

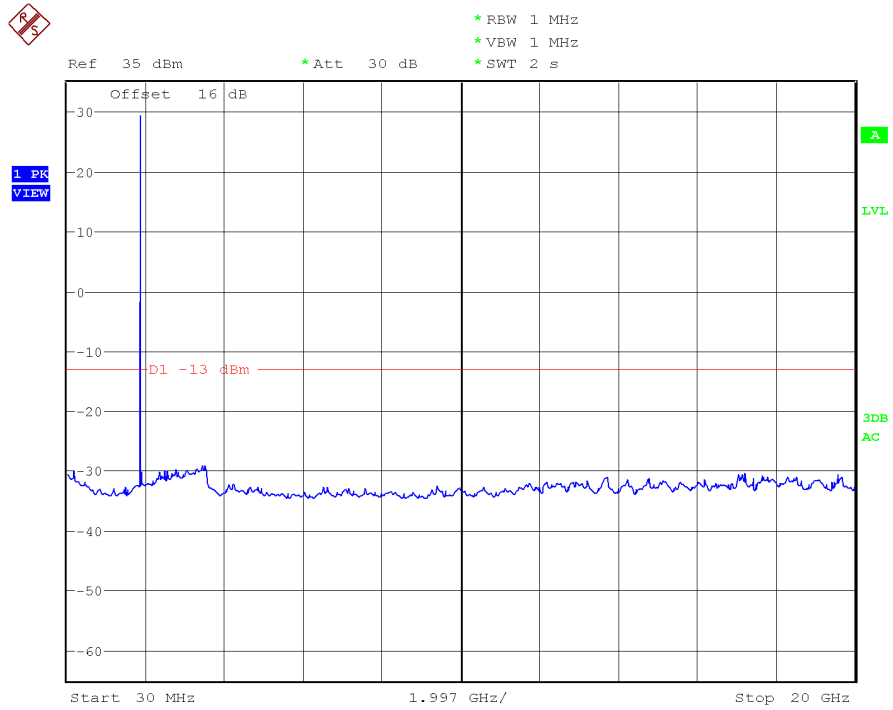
2. CHANNEL: MIDDLE (1880.2 MHz).



Note: The peak above the limit is the carrier frequency.



3. CHANNEL: HIGHEST (1909.8 MHz).



Note: The peak above the limit is the carrier frequency.

## *Spurious emissions at antenna terminals at Block Edges*

### SPECIFICATION

§2.1051 and §24.238

### METHOD

As indicated in FCC part 24, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A resolution bandwidth of 5 kHz was used.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

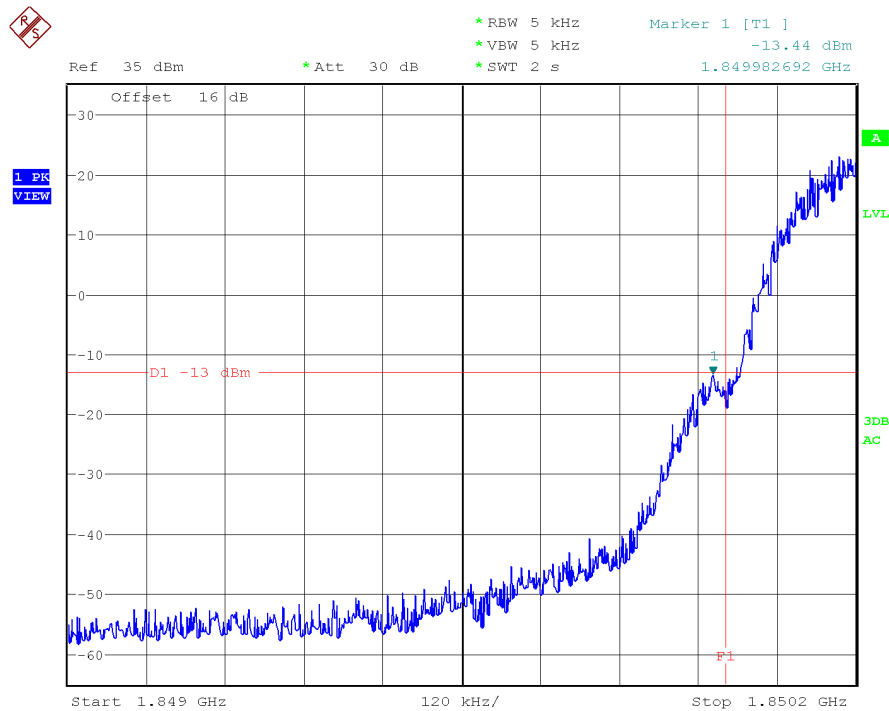
At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

### RESULTS (see plots in next pages)

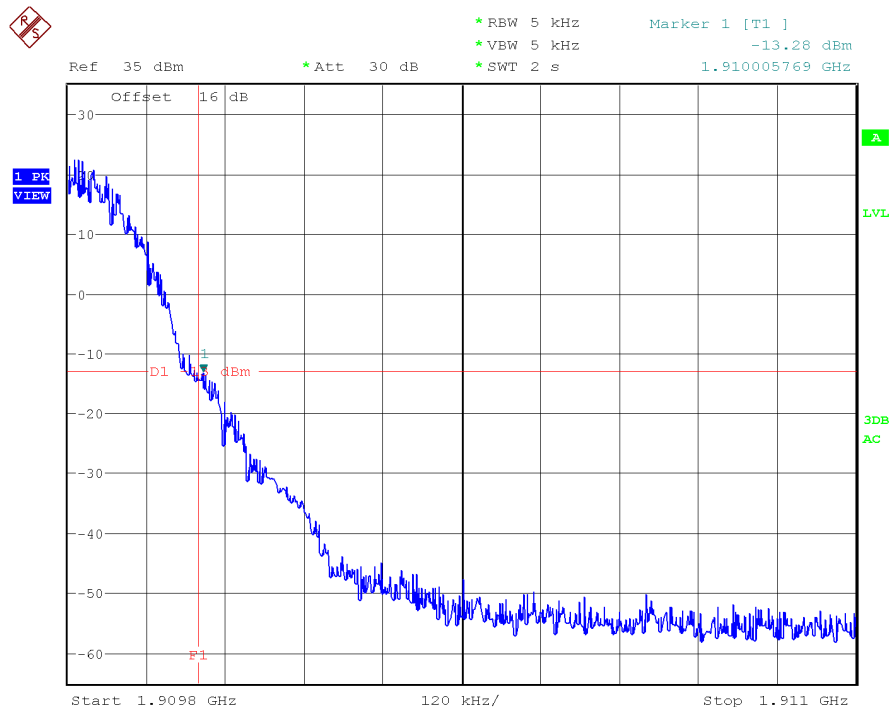
BLOCK	Maximum level at Block Edges (dBm)
A	-13.44
C	-13.28

BLOCK A. CHANNEL LOWEST (1850.2 MHz).



NOTE: The equipment transmits at the maximum output power (PCL = 0).

BLOCK C. CHANNEL HIGHEST (1909.8 MHz).



NOTE: The equipment transmits at the maximum output power (PCL = 0).

Verdict: PASS

## *Radiated emissions*

### SPECIFICATION

§ 24.238

### METHOD

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded. The radiated emissions were measured with peak detector and 1 MHz bandwidth.

Each detected emissions were substituted by the Substitution method, in accordance with the ANSI/TIA/EIA-603-C: 2004.

#### Measurement Limit:

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB, P in watts.

At  $P_o$  transmitting power, the specified minimum attenuation becomes  $43+10\log (P_o)$ , and the level in dBm relative  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mwatts}) - 30] = - 13 \text{ dBm}$$

## RESULTS

1. CHANNEL: LOWEST (1850.2MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-20 GHz.**

No spurious signals were found in all the range.

2. CHANNEL: MIDDLE (1880.2 MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-20 GHz.**

No spurious signals were found in all the range.

3. CHANNEL: HIGHEST (1909.8 MHz).

**Frequency range 30 MHz-1000 MHz.**

No spurious signals were found in all the range.

**Frequency range 1 GHz-20 GHz.**

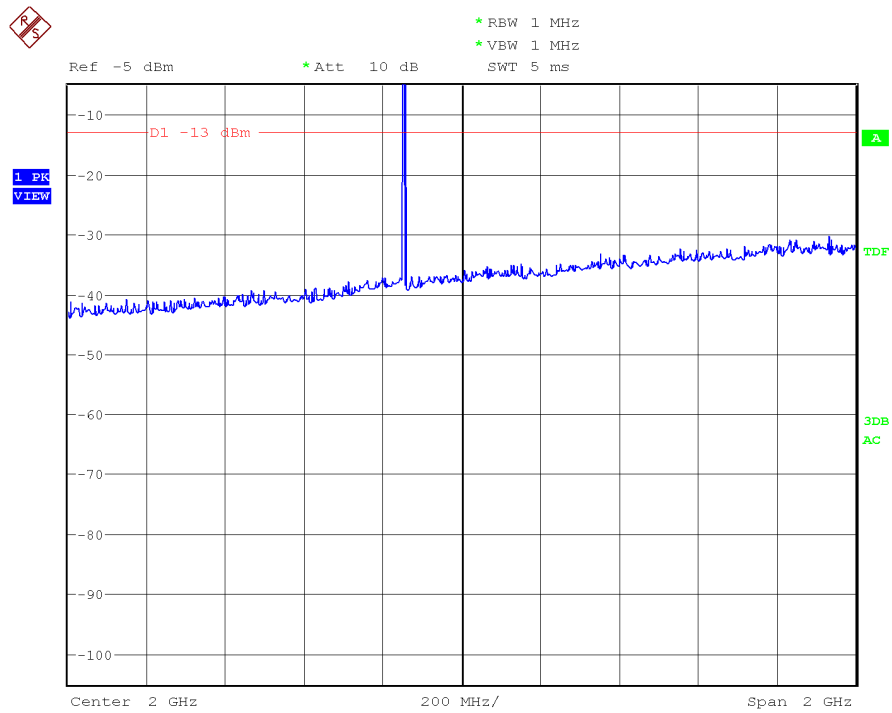
No spurious signals were found in all the range.

Verdict: PASS



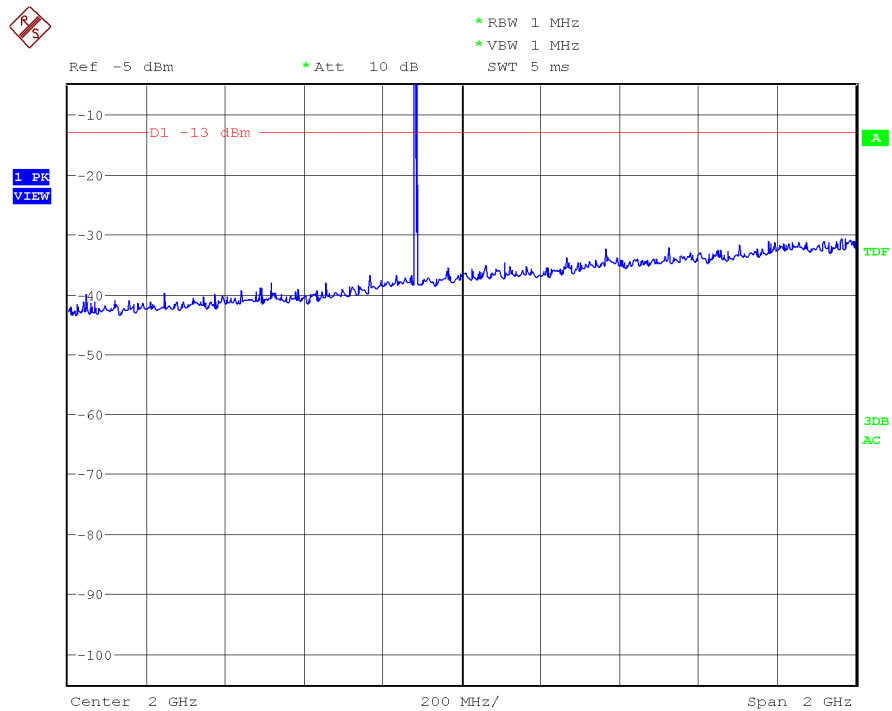
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: LOWEST (1850.2 MHz)



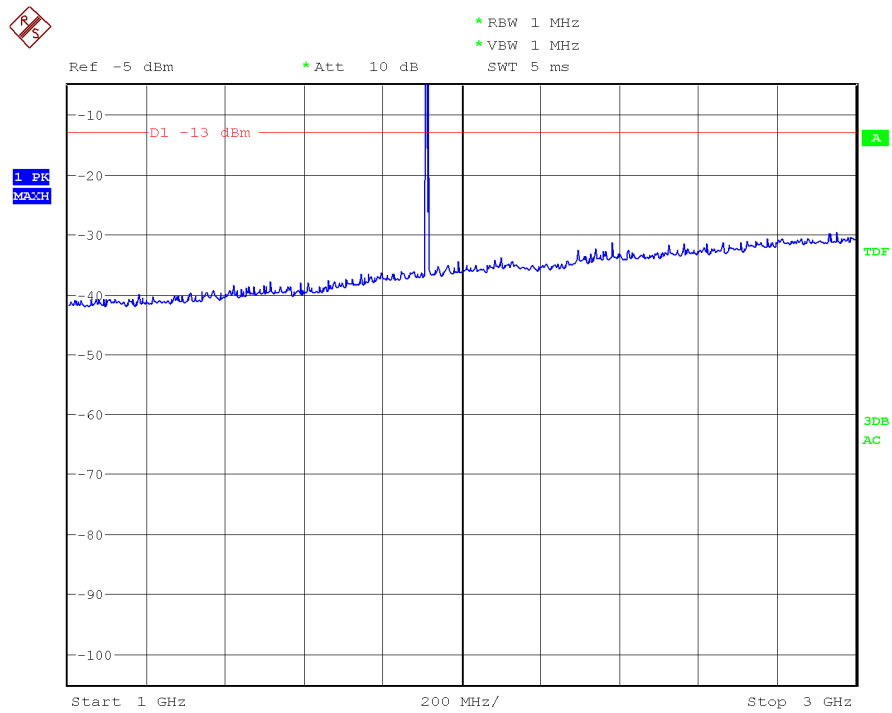
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE (1880.2 MHz)



Note: The peak above the limit is the carrier frequency.

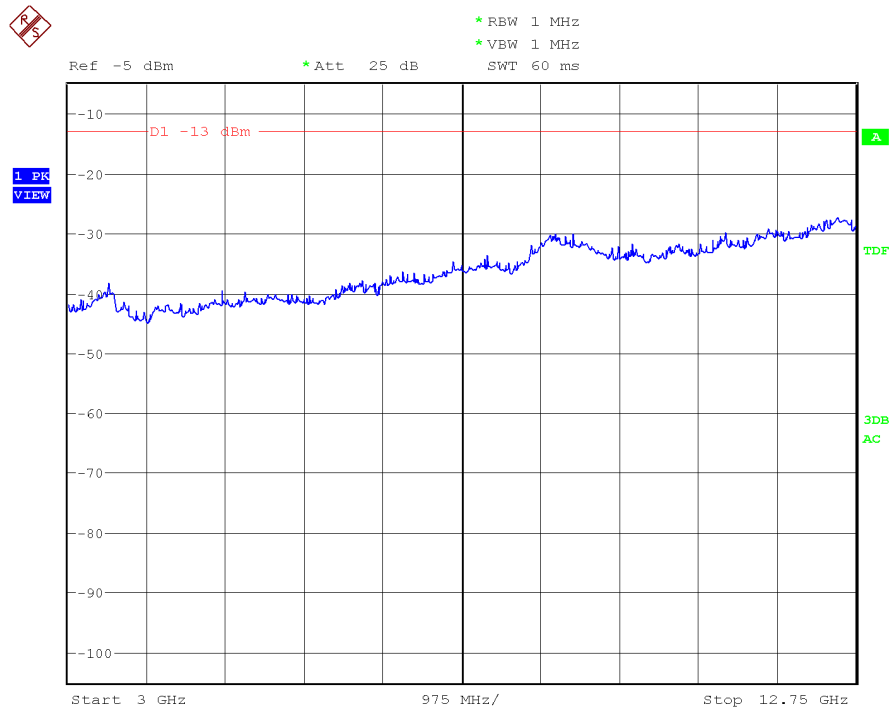
CHANNEL: HIGHEST (1909.8 MHz)



Note: The peak above the limit is the carrier frequency.

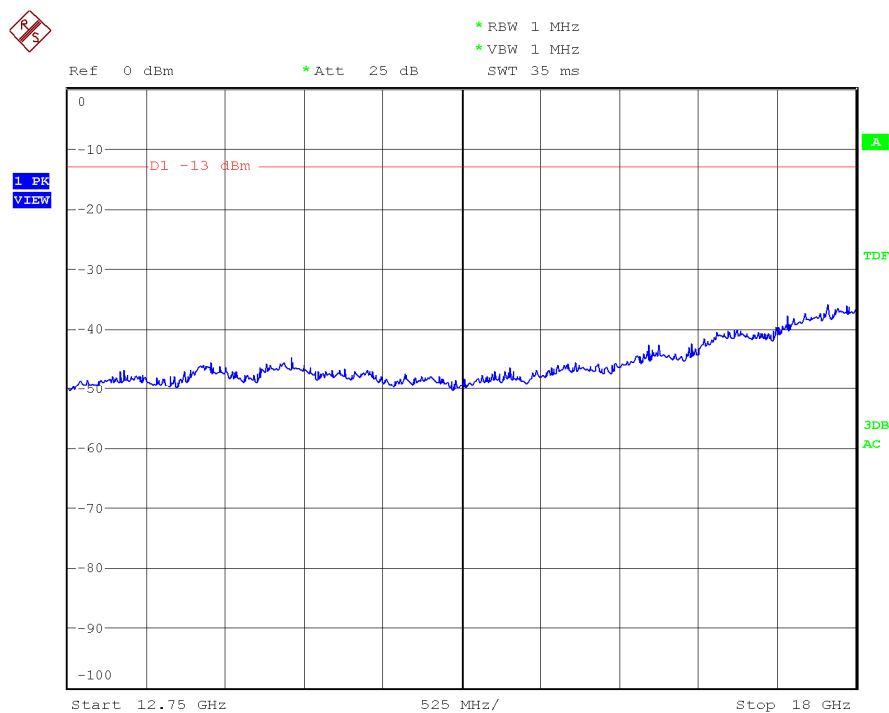


FREQUENCY RANGE 3 GHz to 12.75 GHz.



(This plot is valid for all three channels).

FREQUENCY RANGE 12.75 GHz TO 18 GHz.

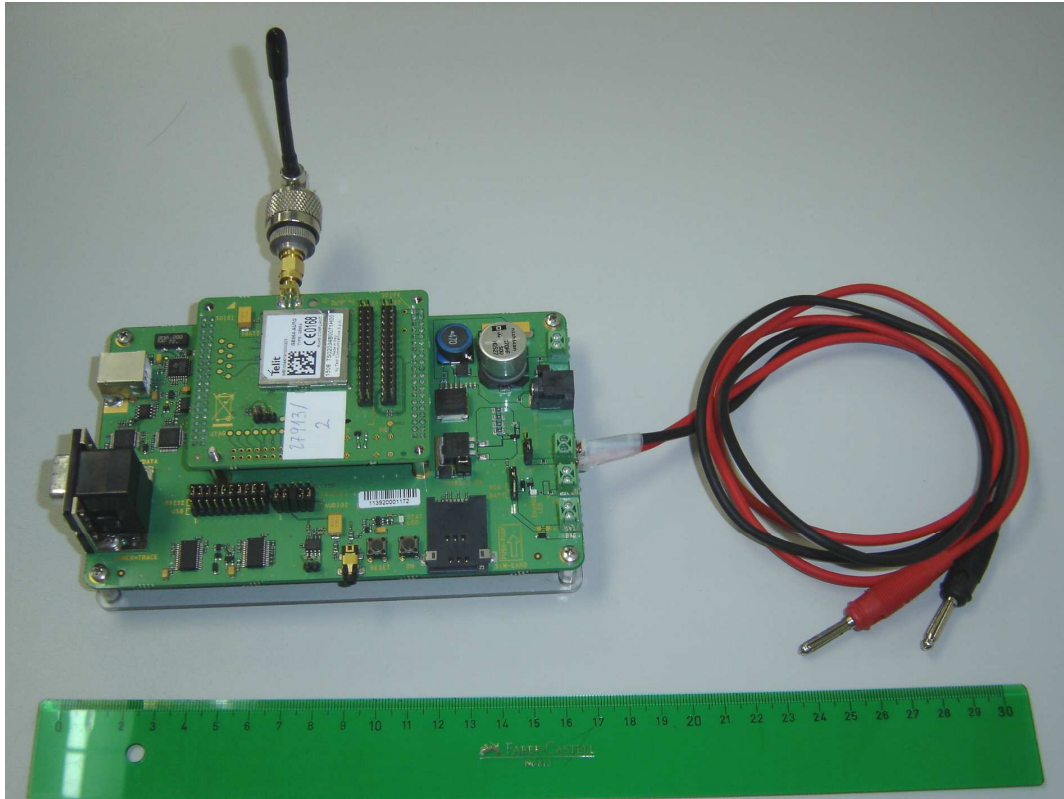


(This plot is valid for all three channels).



## **APPENDIX B: Photographs**

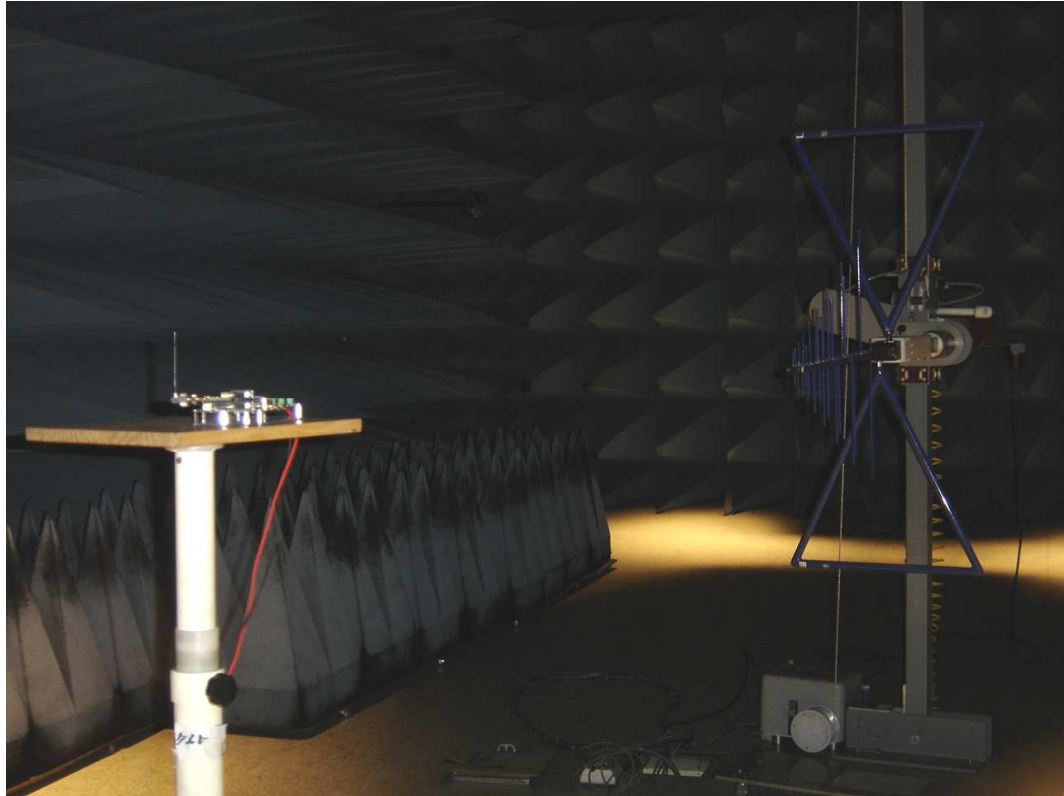
**EQUIPMENT (FRONT VIEW)**



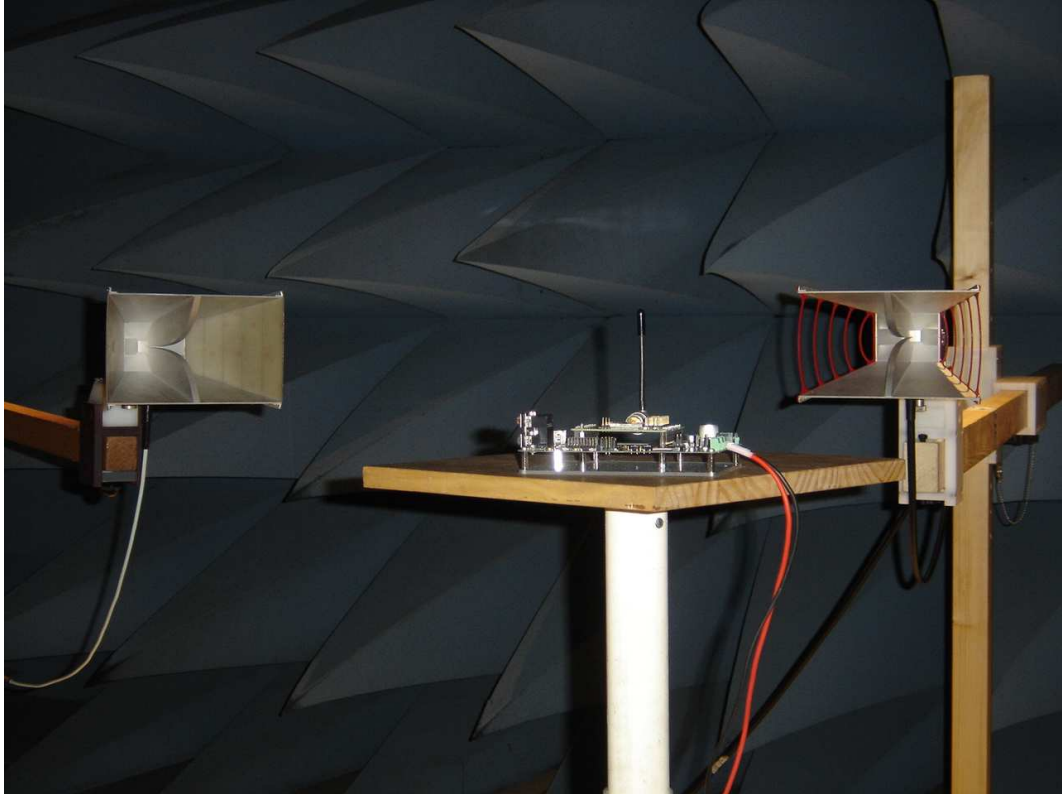
**GENERAL SET-UP FOR RADIATED MEASUREMENTS**



**TEST SET-UP FOR RADIATED MEASUREMENTS BELOW 1 GHz**



**TEST SET-UP FOR RADIATED MEASUREMENTES ABOVE 1GHz**



**TEST SET-UP FOR CONDUCTED MEASUREMENTS**

