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Wireless test report – 406683-3TRFWL

Applicant:

SECO S.p.A.

Product name:

Enhanced sensor to cloud for IOT

Model:

SYS-D47-IOT-0131-1121-C0

FCC ID:

2ALZB-D47IOT

Specifications:

- FCC 47 CFR Parts 2, 22, 24

Date of issue: February 9, 2021

Tested by (name, function and signature)	S. Tessa	(project handler)	Signature:	Sara Tessa
Reviewed by (name, function and signature)	P. Barbieri	(verifier)	Signature:	Paul

Test location(s)

Company name	Nemko Spa
Address	Via del Carroccio, 4
City	Biassono
Province	MB
Postal code	20853
Country	Italy
Telephone	+39 039 220 12 01
Facsimile	+39 039 220 12 21
Website	www.nemko.com
Site number	FCC: 682159 (10 m semi anechoic chamber)

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	SECO S.p.A.
Address	Via A. Grandi – 52100 Arezzo, Italy

1.2 Test specifications

FCC CFR Title 47 Part 2	Frequency allocations and radio treaty matters; general rules and regulations
FCC CFR Title 47 Part 22 Subpart H	Cellular radiotelephone service
FCC CFR Title 47 Part 24 Subpart E	Broadband PCS

1.3 Test methods

ANSI/TIA-603-D-2010	Land mobile FM or PM – Communications equipment – measurement and performance standards
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.5 below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Exclusions

As per quote, the purpose of this report is verification of transmitters colocation. Only inter-modulation products within restricted bands were assessed, other requirements were excluded from the scope of this report.

1.6 Test report revision history

Revision #	Date of issue	Details of changes made to test report
406683-3TRFWL	February 9, 2021	Original report issued

Section 2. Summary of test results

2.1 FCC test results

Part	Test description	Verdict
§22.913 (a)(2), §24.232 (c)	Peak output power.	Pass

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	December 9, 2020
Nemko sample ID number	4066830001

3.2 EUT information

Product name	Enhanced sensor to cloud for IOT
Model	SYS-D47-IOT-0131-1121-C0
Serial number	-

3.3 Technical information

Frequency band	GSM Bands 850 and PCS 1900
Type of modulation	GMSK
Emission classification (F1D, G1D, D1D)	F1D
EUT power requirements	9 - 24 V_{DC}, 1.3-3.5 A
Antenna information	External

3.4 EUT setup diagram

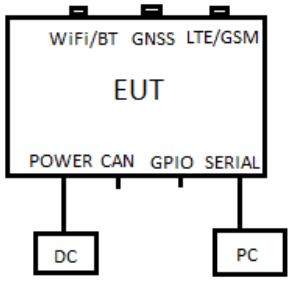


Figure 3.4-1: *Setup diagram*

3.5 Product description and theory of operation

SENSE D47 is a boxed module with a form factor of just 110 x 91 x 31 mm based on a module of Espressif ESP32-WROVER and SIMCOM. This module is suitable both for IoT applications, due to its rich connectivity, and for industrial applications. The EUT features a wide range of connectivity capabilities: it integrates Wi-Fi, Bluetooth, GSM/GPRS and GPS.

3.6 EUT sub assemblies

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
-	-	-	-

3.7 EUT exercise details

EUT was set to continuously transmit mode during tests. Radio modules were configured in continuous transmission with the ability to adjust modulation, frequency and output power as required.

Cellular – using radio tester CMW250.

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

No Technical judgment

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Temperature	18 – 33 °C
Relative humidity	25 – 70 %
Air pressure	860 – 1060 mbar

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	2020-12	2022-12
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2020-12	2022-12
Barometer	Castle	GPB 3300	072015	2020-03	2021-03

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)

Section 6: Measurement uncertainty

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2020-08	2021-08
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESW44	101620	2020-08	2021-08
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	2018-07	2021-07
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137	2020-09	2021-09
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2019-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 22.913(a)(2), 24.232(c) Peak output power

1. Definitions and limits

FCC:

22.913

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232

The EIRP of mobile transmitters and auxiliary test transmitters must not exceed 2 Watts.

2. Test date

Start date	April 15, 2020

3. Observations, settings and special notes

The test was performed using CMW250.

4. Test data

Table 8.1-1: *Output power measurements results, GSM 850*

Channel	Conducted power dBm	Conducted power W
128 (Low)	29.79	0.96
189 (Mid)	29.73	0.94
251 (High)	29.77	0.96

Table 8.1-2: *Output power measurements results, GSM 1900*

Channel	Conducted power dBm	Conducted power W
512 (Low)	28.08	0.65
661 (Mid)	28.31	0.68
810 (High)	27.86	0.62

Table 8.1-3: *Output power measurements results, GSM 850*

Channel	Radiated power dBm	Radiated power W	Limit W	Margin, W
128 (Low)	32.79	1.90	7	5.10
128 (Low)	36.30	4.27	7	2.73
189 (Mid)	35.20	3.32	7	3.68
189 (Mid)	38.16	6.60	7	0.40
251 (High)	35.13	3.32	7	3.68
251 (High)	36.77	4.79	7	2.21

Table 8.1-4: *Output power measurements results, GSM 1900*

Channel	Radiated power dBm	Radiated power W	Limit W	Margin, W
512 (Low)	23.36	0.22	2	1.78
512 (Low)	20.18	0.11	2	1.89
661 (Mid)	22.11	0.17	2	1.83
661 (Mid)	26.96	0.51	2	1.49
810 (High)	19.53	0.10	2	1.90
810 (High)	29.18	0.83	2	1.17

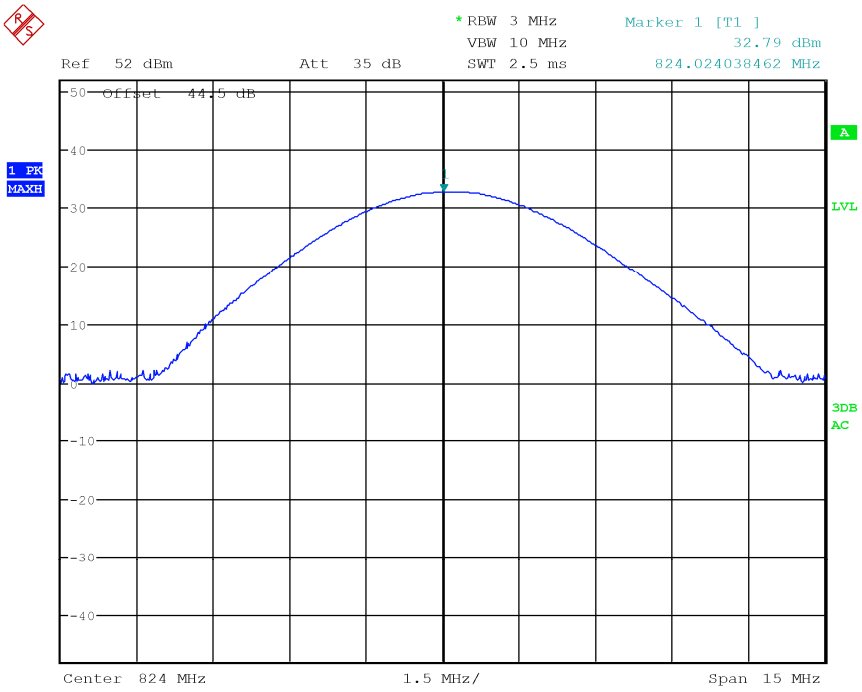


Figure 8.1-1: *Output power of GSM 850, channel LOW polH*

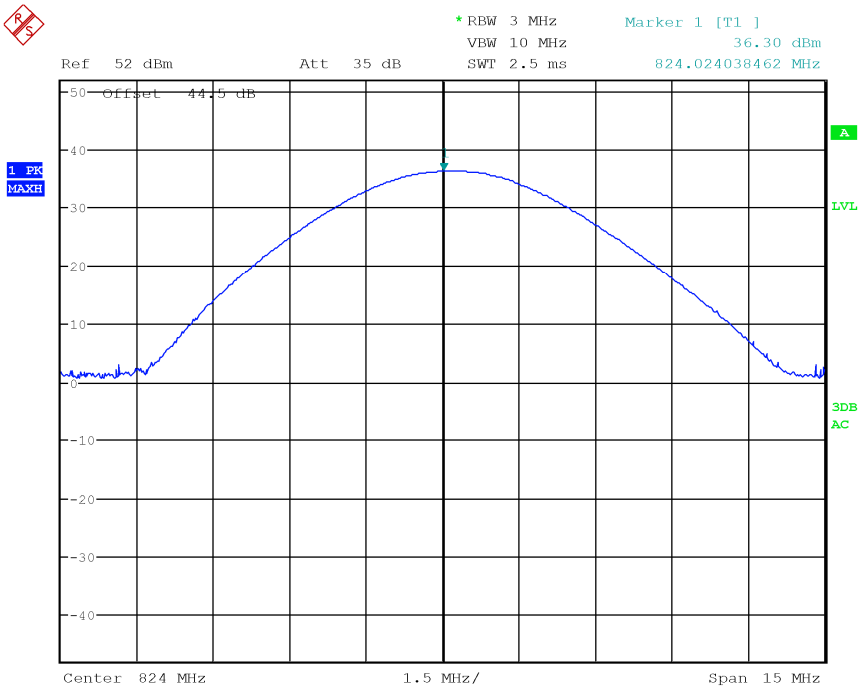


Figure 8.1-2: *Output power of GSM 850, channel LOW polV*

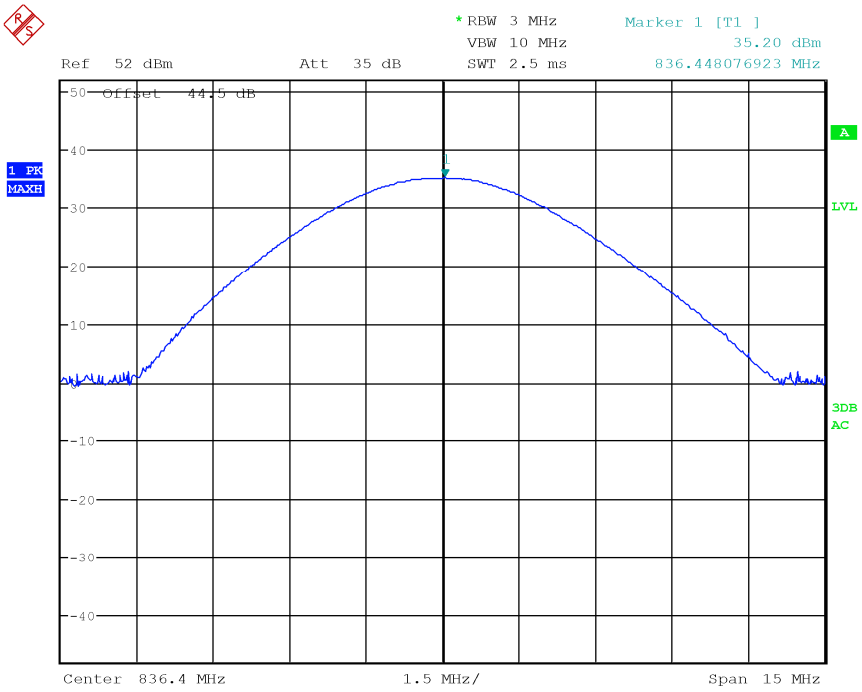


Figure 8.1-3: *Output power of GSM 850, channel Mid polH*

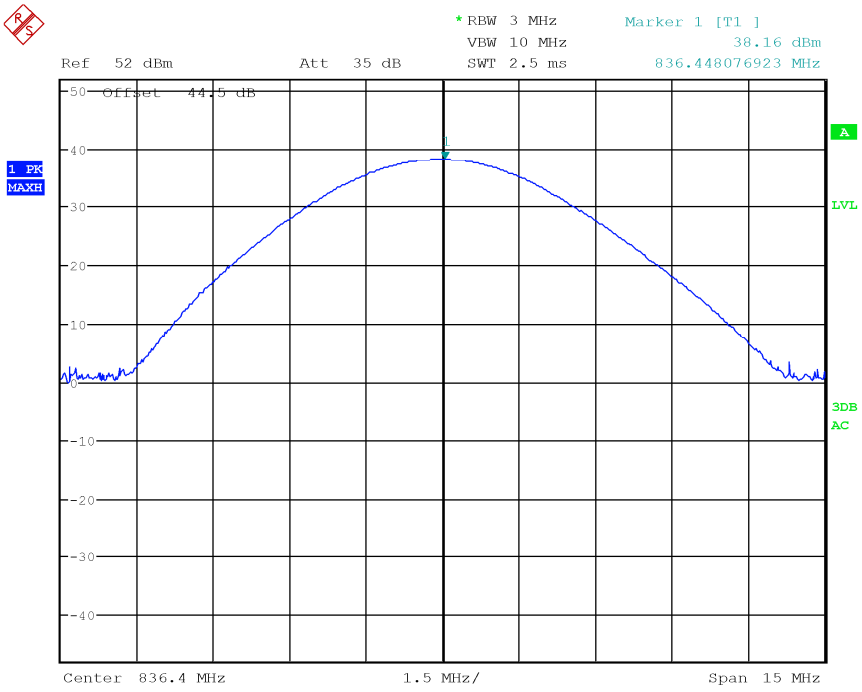


Figure 8.1-4: *Output power of GSM 850, channel Mid polV*

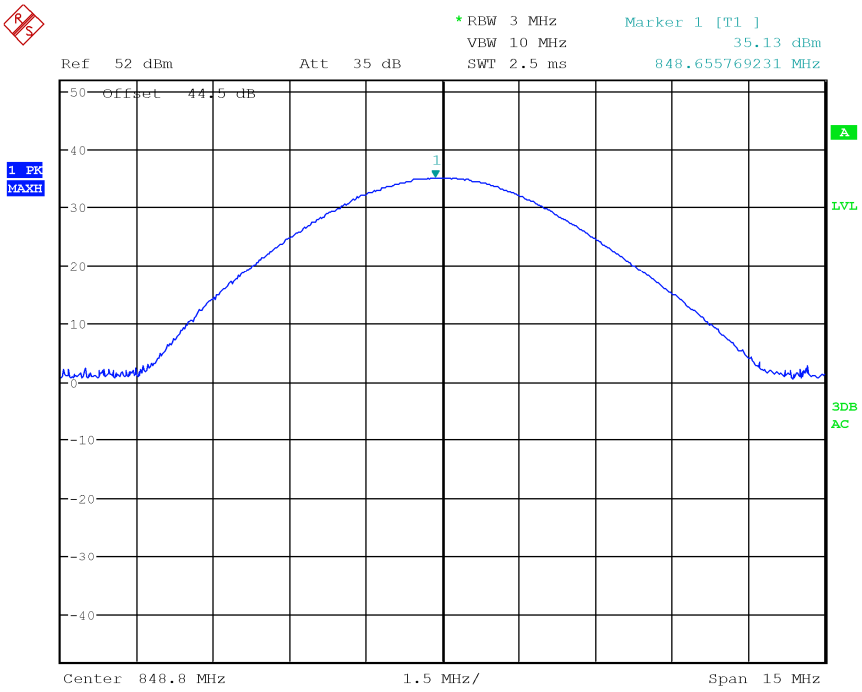


Figure 8.1-5: *Output power of GSM 850, channel High polH*

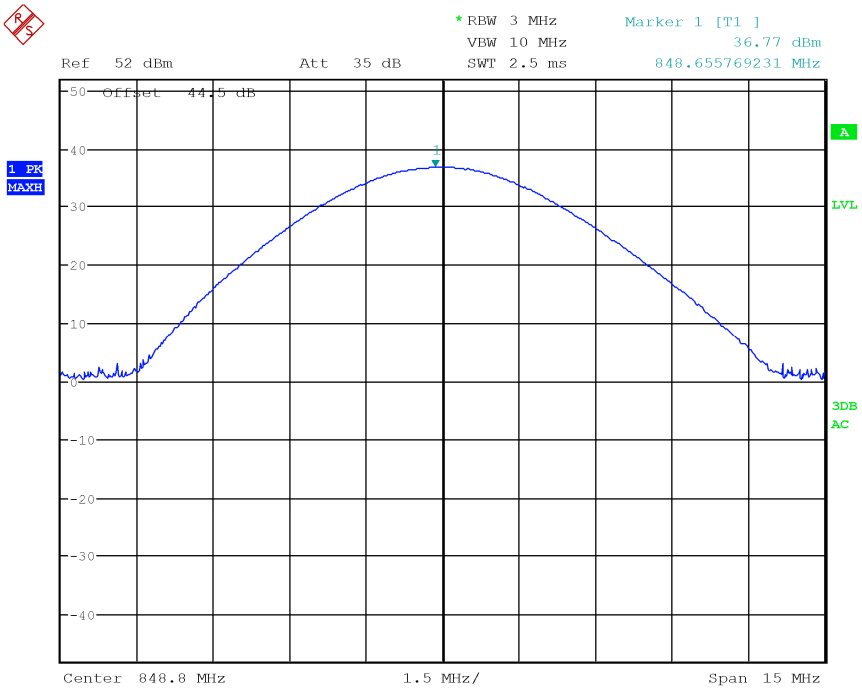


Figure 8.1-6: *Output power of GSM 850, channel High polV*

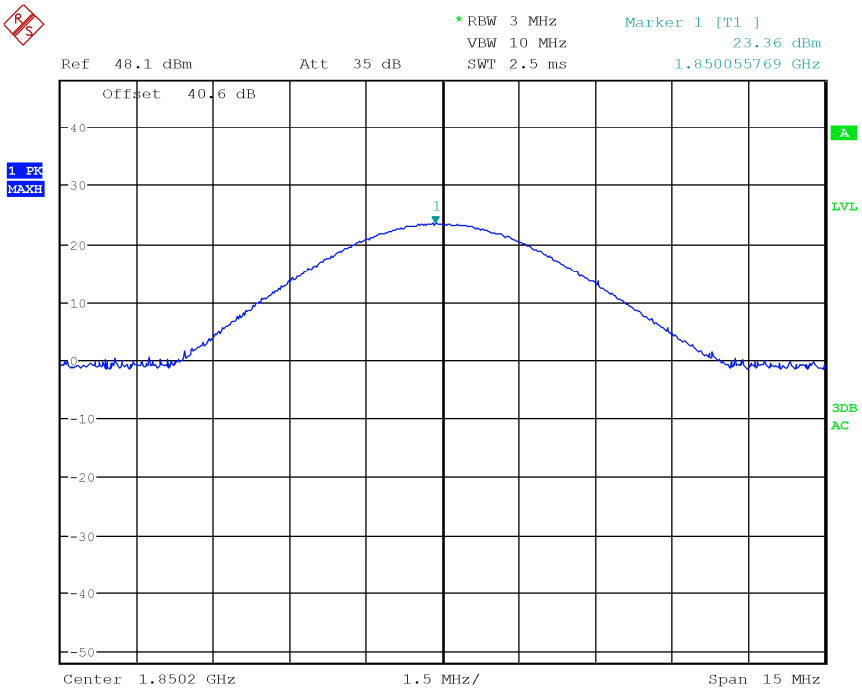


Figure 8.1-7: *Output power of GSM 1900, channel LOW polH*

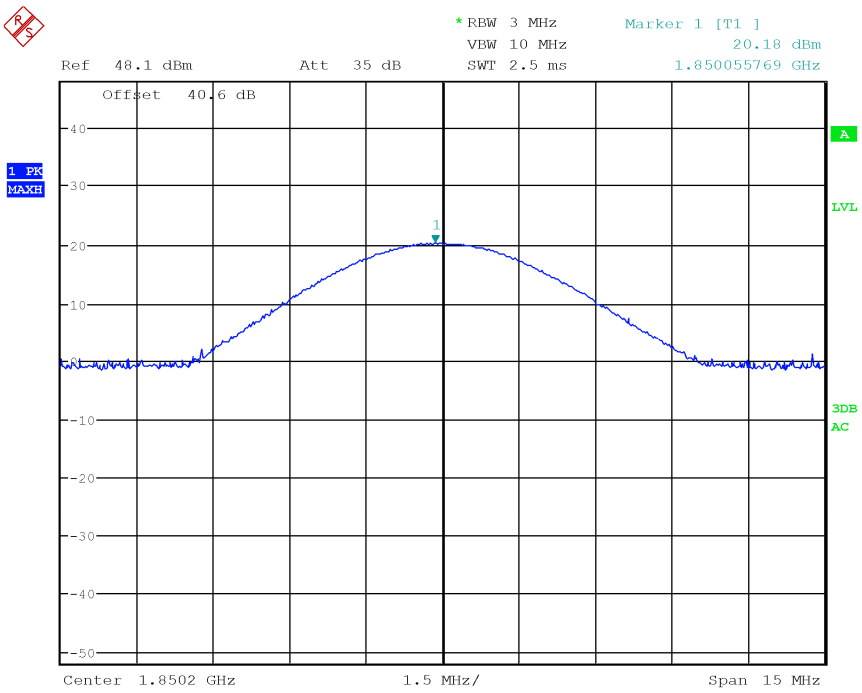


Figure 8.1-8: *Output power of GSM 1900, channel LOW polV*

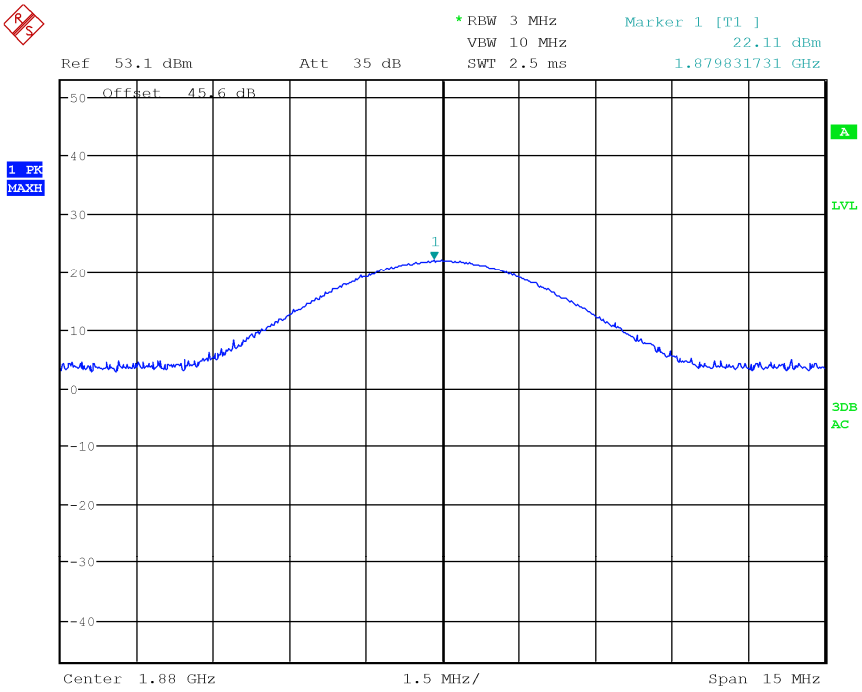


Figure 8.1-9: *Output power of GSM 1900, channel Mid polH*

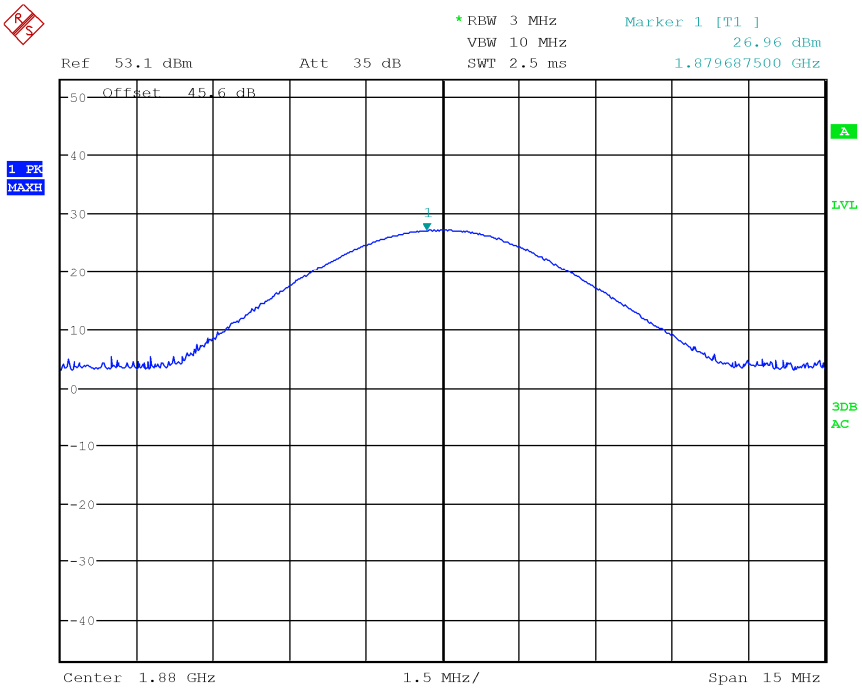


Figure 8.1-10: *Output power of GSM 1900, channel Mid polV*

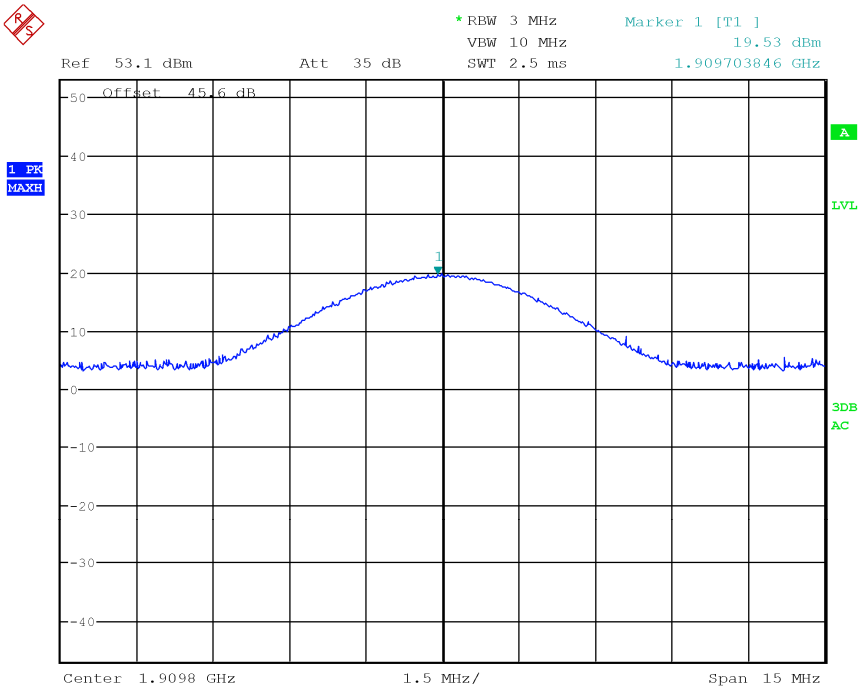


Figure 8.1-11: *Output power of GSM 1900, channel High polH*

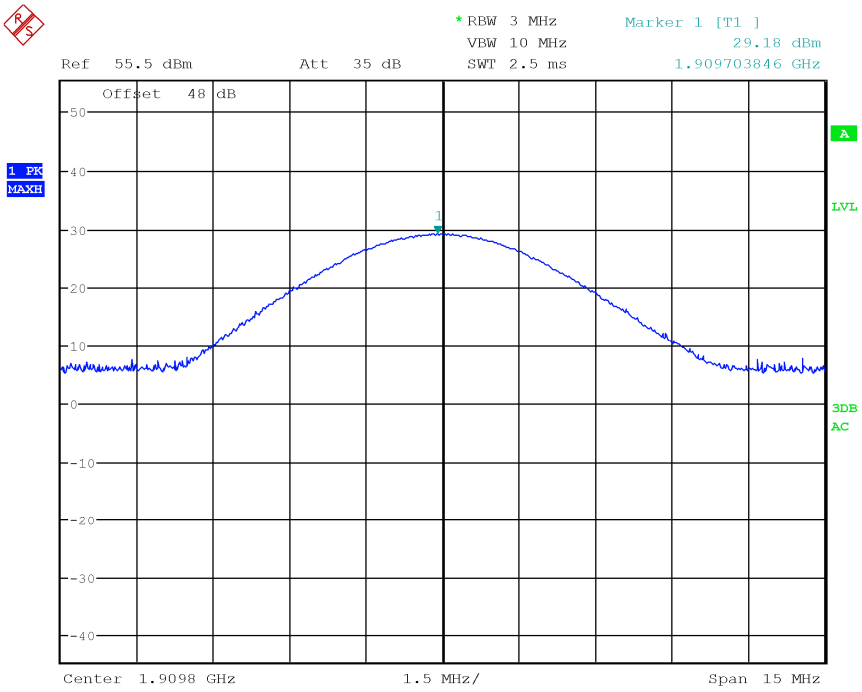


Figure 8.1-12: *Output power of GSM 1900, channel High polV*

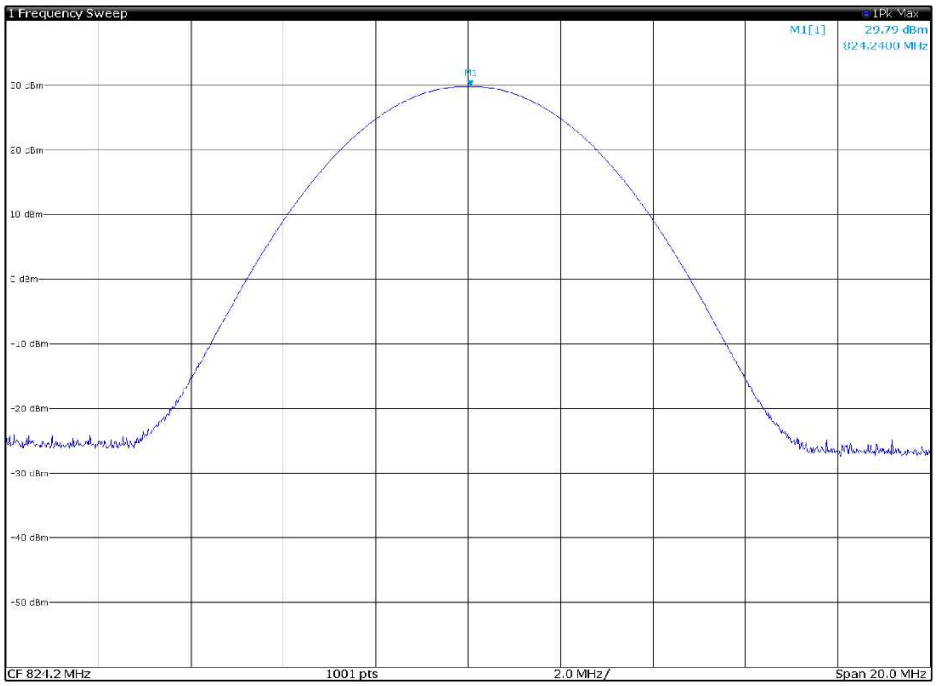


Figure 8.1-13: *Output power, 850 channel LOW*

Figure 8.1-14: *Output power of GSM 850, channel MID*

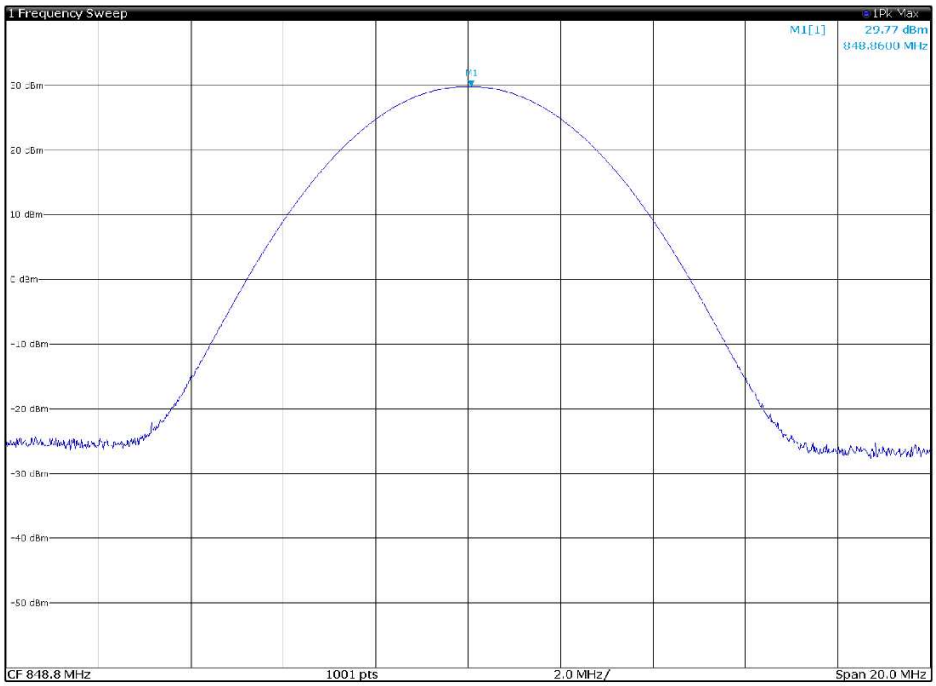


Figure 8.1-15: *Output power of GSM 850, channel High*

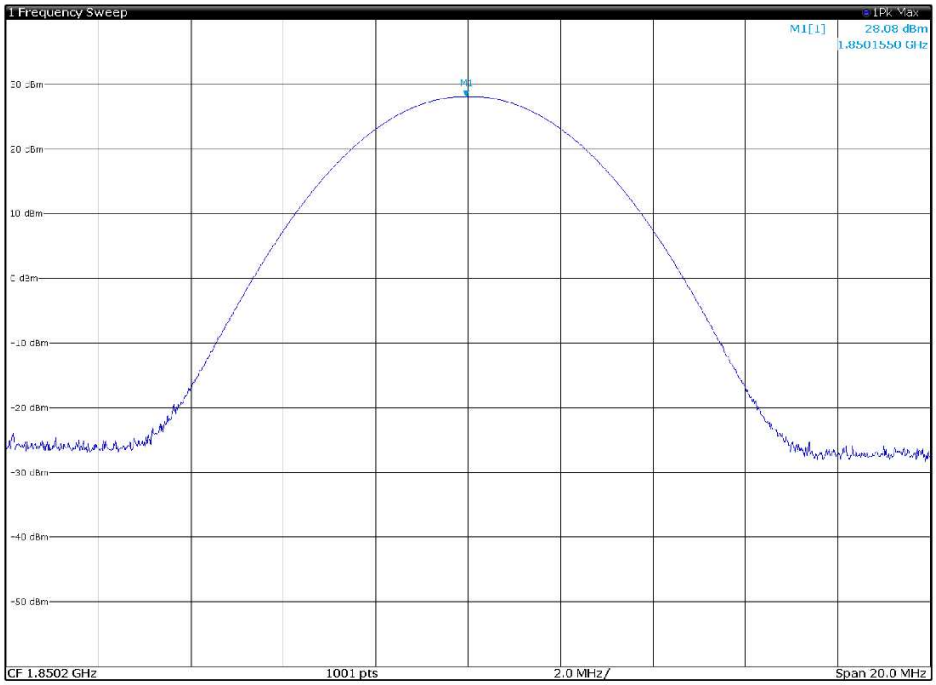


Figure 8.1-16: *Output power of GSM 1900, channel Low*

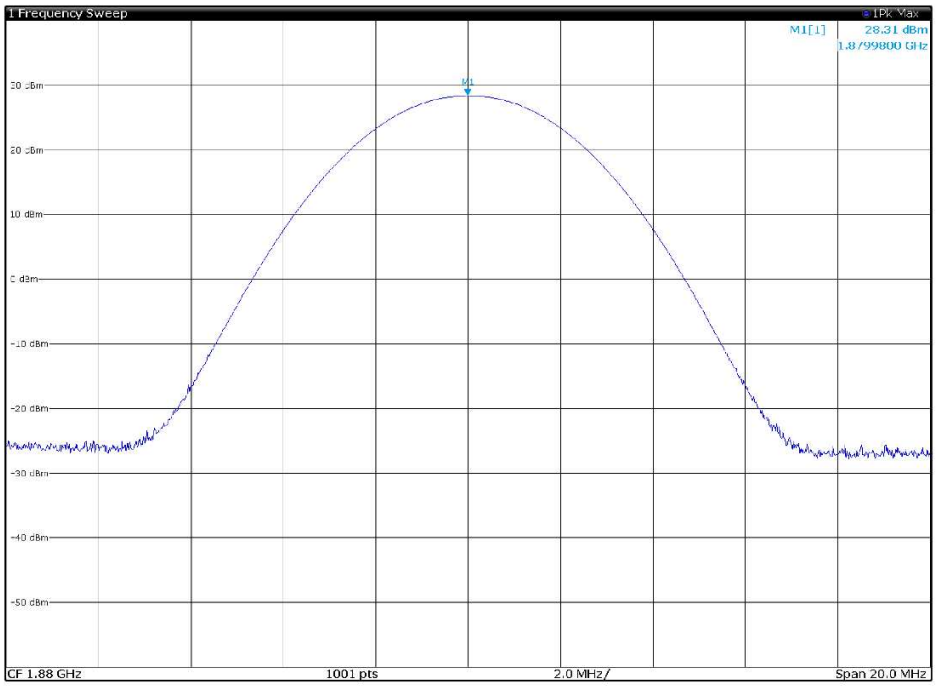


Figure 8.1-17: *Output power of GSM 1900, channel Mid*

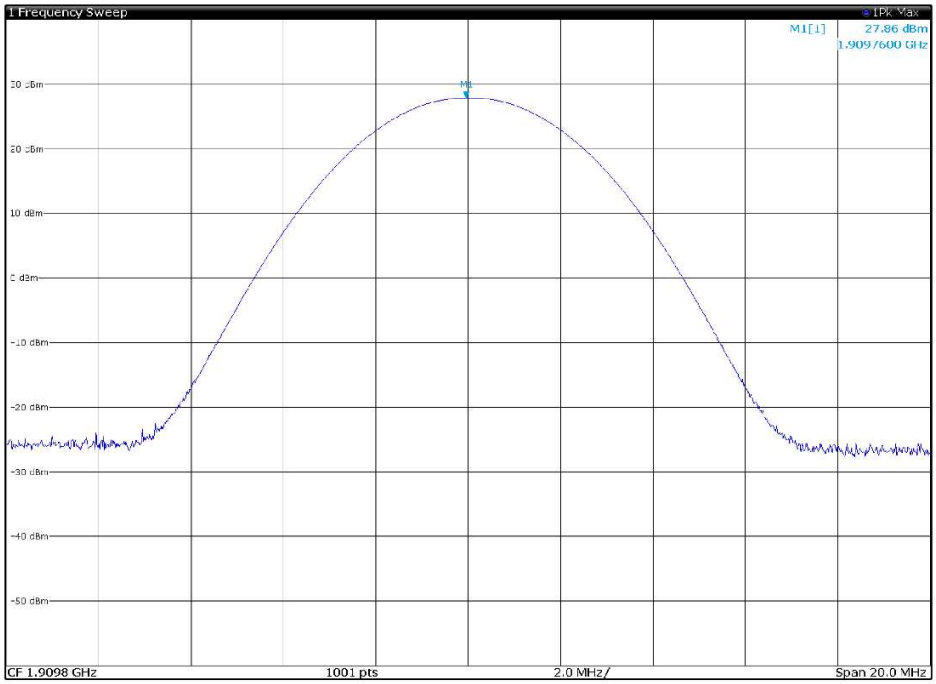
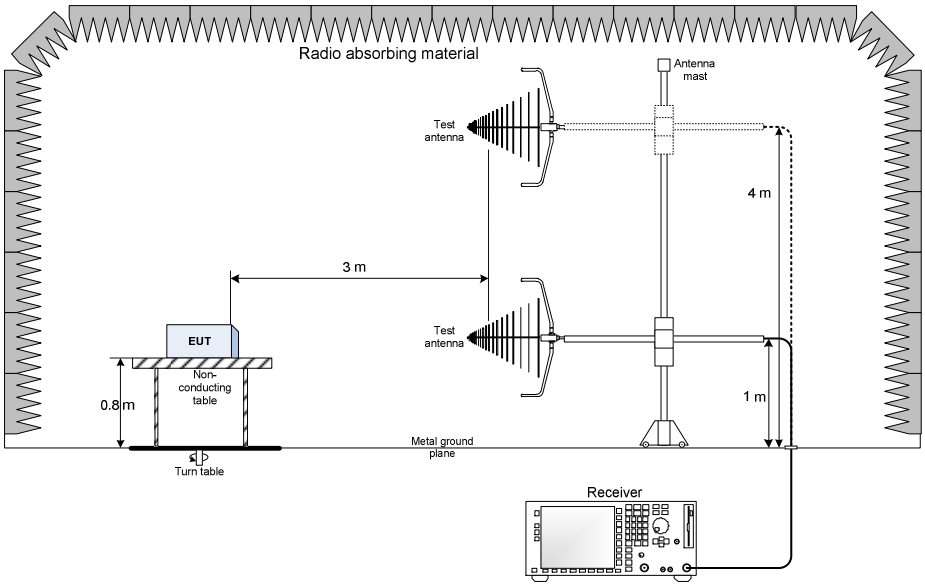


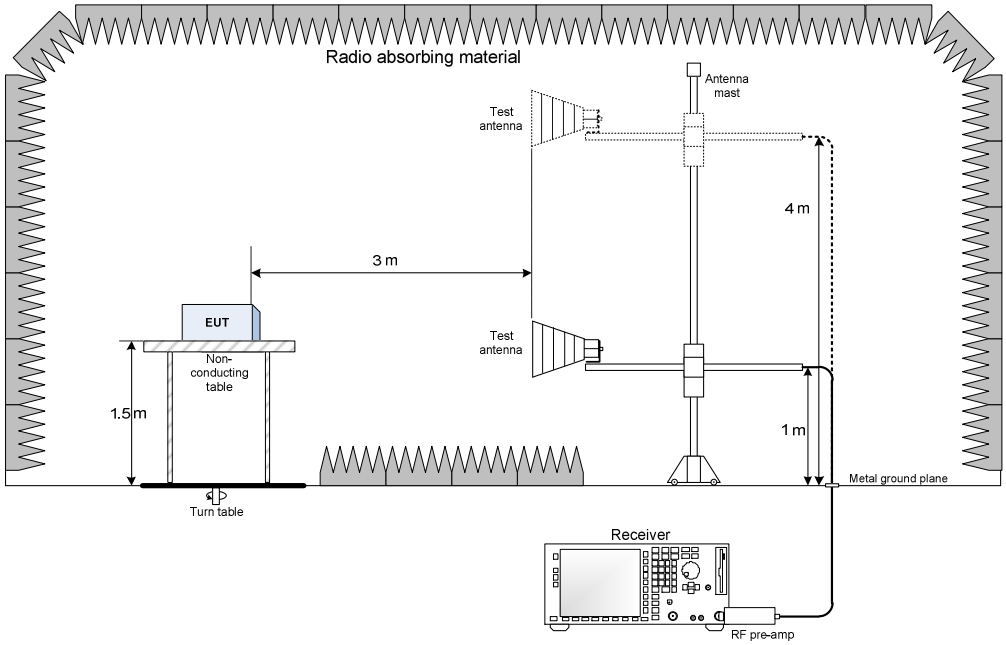
Figure 8.1-18: *Output power of GSM 1900, channel High*

Section 9. Block diagrams of test set-ups

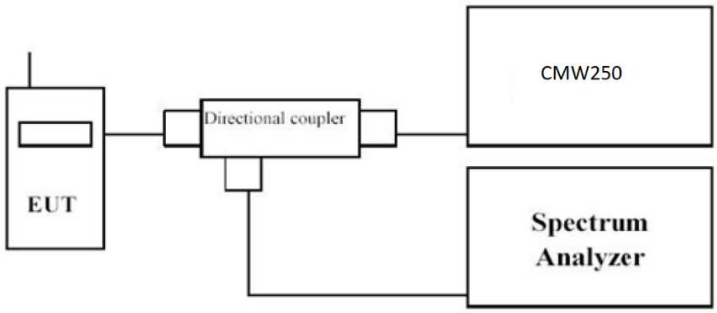
9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



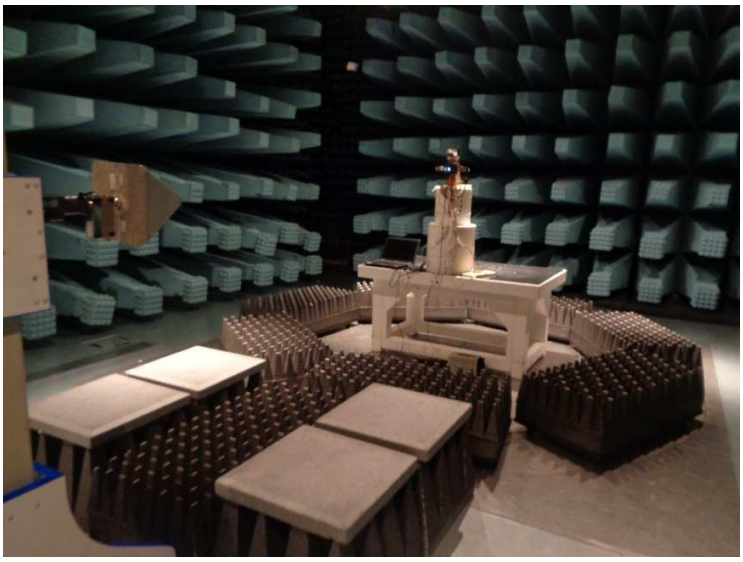
9.3 Conducted output power set-up



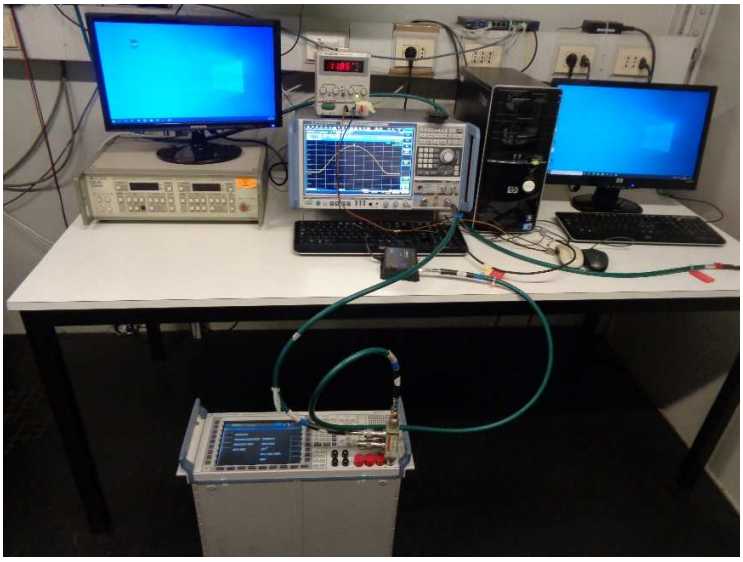
Section 10. Photos

10.1 Photos of the test set-up

Radiated emission below 1 GHz



Radiated emission above 1 GHz



Conducted output power

10.2 Photos of the EUT

(End of report)