Test Plan and Test Results

BS-240XLU II BTS Base Station

FCC ID: NE3PCS010

Name of Applicant

Siemens Information and Communication Mobile, Inc.
900 Broken Sound Parkway
Boca Raton, FL 33487

Tester:	Mr. Fenske Mr. Huber	Author:	Mr. Fenske Mr. Huber	Approved:	Dr.-Ing. Khelifi Director CQE 21 Mr. Bauer Director CQE 13
Signature:					
Date:	09/02/2005		09/02/2005		09/02/2005
Phone:	+49 89 722 57389 +49 89 722 25434		+49 89 722 57389 +49 89 722 25434		+49 89 722 34180 +49 89 722 44387

Address: Siemens AG, Com CTO CQE, Hofmannstr. 51, D-81359 München, Phone +49 89-722-48793, Fax +49 89-722-22648, Internet http://www.pruefinstitut.de

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1 Equipment under test (EUT)

The equipment under test (EUT) comprises the modules listed in the table below.

Module Name	Siemens Part No.	Serial No.	Test No.
FCU850V1	S30861-U2409-X-04/01	UEB/SN216141	1, 2, 3, 4, 7
FDUAMCO850V2 (in 2:2 mode)	S30861-U2413-X-04/01	RMX/S3000013	1, 2, 3, 4, 7
FCU850V1	S30861-U2409-X-04/01	UEB/SN216150	5
FCU850V1	S30861-U2409-X-04/01	UEB/SN216141	5
FDUAMCO850V2 (in 4:2 mode)	S30861-U2413-X-05/01	RMX/S9600181	5
FCU850V1	S30861-U2409-X-04/01	UEB/SN216150	6
FCU850V1	S30861-U2409-X-04/01	UEB/SN216141	6
FDUAMCO850V2 (in 4:2 mode)	S30861-U2413-X-05/01	RMX/S9600181	6

For a functional description of the modules, please refer to the appropriate related parts and exhibit sections of this certification application.

The tests were conducted with the modules installed in a BS-240XLU II. Worst-case measurement data is reported.

To comply with the FCC rules (§2.1051, §22.917), the maximum transmit power at the antenna port of channel numbers 128 (869.2 MHz) and 251 (893.8 MHz) is decreased according to the following table.

Type of ECU	Carrier Frequency [MHz]	Channel No.	Maximum RF power output GMSK	Maximum RF power output 8PSK
FCU850V1	869.2	128	38.8 dBm = 7.6 W	41.8 dBm = 15.1 W
FCU850V1	893.8	251	38.2 dBm = 6.6 W	41.5 dBm = 14.1 W

A complete description of the transceiver's calibration/tuning procedure is included in the Parts List and TuneUp exhibit section of this application.

2 Measurements

2.1 General description

2.1.1 EUT configuration and operating conditions

If not stated otherwise, the following standard setup procedure for the EUT under test was used:

A BSC simulator is used to control the EUT and is connected to the EUT via the A_{bis} Link. For detailed test system equipment configuration please refer to Fig.1 on page 6.

The transmitter modules were tuned up according to the procedure described in the TuneUp exhibit section of this application.

During the measurements, one carrier channel was tested at a time. The carrier was set to the maximum power level with all timeslots activated to ensure the maximum emission amplitudes during all measurements.

A pseudo random bit pattern was applied to the digital modulator. This ensures that the measurements of the emission characteristics of the transmitter are pursuant to § 2.1049.

2.1.2 Selected carrier test frequencies

The measurements were performed at 3 selected carrier test frequencies, according to the following table:

Carrier Test Frequency [MHz]	Remark
869.2	lowest possible carrier frequency
881.6	frequency at the middle of the band
893.8	highest possible carrier frequency

2.1.3 Modulation characteristics

The EUT supports two types of modulation: GMSK and 8PSK. The modulation characteristic of the GMSK and the 8PSK modulation is defined in standard 3GPP TS 05.04.

During all measurements described below, a pseudo random sequence was applied to the digital modulator to ensure that the emission characteristics of the transmitter are pursuant to § 2.1049.

2.1.4 Measurement test configuration

If not stated otherwise, the following measurement configuration was used to perform all measurements (see figure below):

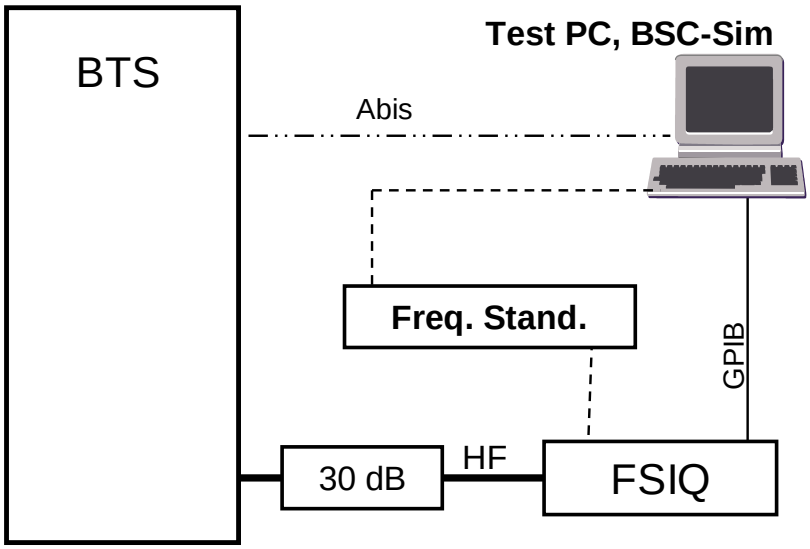

Fig. 1 – Measurement Test Configuration

The EUT is controlled by a BSC simulator via the serial A_{bis} Link. The RF output signal is connected to a spectrum analyzer (FSIQ26, Rohde&Schwarz) via a high power 30 dB attenuator. The attenuator is used to protect the input of the spectrum analyzer from high RF power levels. A description of the analyzer settings is given in each of the sections describing the measurements. A complete list of the measurement equipment is included on page 21 of this measurement report.
The measurements were performed at Siemens AG, Center for Quality Engineering, Hofmannstr. 50, 81359 Munich, Germany.

2.1.5 Calibration of the measurement equipment

The spectrum analyzer has a built-in self-calibration procedure. This calibration procedure was activated prior to the measurements so that the analyzer is deemed accurate. High quality cables were used to connect the measurement equipment to the EUT. The actual loss of the attenuator and the cables was measured with a high precision network analyzer and taken into account for all measurements.

2.2 Summary of the measurements

The measurements described in the following sections were conducted pursuant to 47 CFR § 2.947. All applicable paragraphs of the 47 CFR parts 2 and 22 of the most current version of the rules were considered.

The following tests were performed according to the FCC rules in order to verify the compliance of the EUT with the FCC requirements:

Test No.	Measurement	FCC Rule	Page Number of this Report	Results
1	RF power output	§ 2.1046	8	compliant
2	Modulation characteristics	§ 2.1047, § 2.201	9	compliant
3	Occupied bandwidth	§ 2.1049	10	compliant
4	Spurious emissions at antenna terminals	§ 2.1051, § 2.1057, § 22.917	11	compliant
5	Field strength of spurious radiation	§ 2.1053, § 2.1057, § 22.917	14	compliant
6	Frequency stability	§ 2.1055, § 22.355	17	compliant
7	Slow frequency hopping	N/A	19	compliant

In accordance with the FCC Rule §15.3 (z) the equipment was tested with the limits that are valid for an *unintentional radiator*.

2.3 Test No. 1: RF power output (§ 2.1046)

2.3.1 Purpose

The RF power output measurements were performed pursuant to § 2.1046 in order to determine the peak rated RF output power of the EUT.

2.3.2 EUT operation condition

The standard setup procedure as described in section 2.1.1 of this report was used. The maximum transmit power of channel number 128 (869.2 MHz) and 251 (893.8 MHz) was set according to section 1.

2.3.3 Test configuration

The test configuration used is described in the block diagram in section 2.1.4 (page 6, Fig. 1).

2.3.4 Measurement procedure and results

Using a spectrum analyzer the RF power is measured with a frequency sweep across the carrier (see screenshots). The carrier power is the maximum indicated power level. The base station maximum output power is the sum of the measured carrier power and the external attenuation (cable loss of the test set up).
The following table shows the measured output powers at the RF output terminal. Spectral plots are included on pages 23 – 28 of this report.

Note:
The offset value indicated on the spectral plots represents the external attenuation value that includes the fixed attenuator plus the cable loss.

GMSK modulation

Carrier Test Frequency [MHz]	Indicated Power Level [dBm]	External Attenuation [dB]	RF Power	Results
869.2	4.9	-32.4	37.3 dBm = 5.4 W	compliant
869.4	12.5	-32.4	44.9 dBm = 30.9 W	compliant
881.6	12.9	-32.4	45.3 dBm = 33.9 W	compliant
893.6	12.4	-32.4	44.8 dBm = 30.2 W	compliant
893.8	4.3	-32.4	36.7 dBm = 4.7 W	compliant

8PSK modulation

Carrier Test Frequency [MHz]	Indicated Power Level [dBm]	External Attenuation [dB]	RF Power	Results
869.2	7.9	-32.4	40.3 dBm = 10.7 W	compliant
869.4	12.5	-32.4	44.9 dBm = 30.9 W	compliant
881.6	12.9	-32.4	45.3 dBm = 33.9 W	compliant
893.6	12.4	-32.4	44.8 dBm = 30.2 W	compliant
893.8	7.6	-32.4	40.0 dBm = 10.0 W	compliant

The measured power levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

2.4 Test No. 2: Modulation characteristics (§ 2.1047, § 2.201)

The occupied bandwidth was measured to be 253kHz, which represents the 99% power bandwidth (refer to the spectral plots included on pages 29 – 34 and the following section). Five carrier test frequencies were investigated. Including all measurement uncertainties the modulation characteristic of the base stations transceiver is **258KGXW**.
No further testing is required under this section of the FCC rules. No measurements other than the occupied bandwidth are required.

The modulation characteristics were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

2.5 Test No. 3: Occupied bandwidth (§ 2.1049)

2.5.1 Purpose

The measurements are performed to determine the occupied bandwidth of the EUT pursuant to § 2.1049.

2.5.2 EUT operation condition

The EUT was set up according to section 2.1.1 of this test report. A pseudo random bit pattern was applied to the modulator. First the test transceiver was modulated using GMSK modulation. Afterwards the measurements were repeated with 8PSK modulation. For a specific modulation technique description, please see section XII of the "Certification Application Overview", located in the cover letter section of this application. For circuit diagrams of the modulator please refer to the Schematics exhibit section of this application. The maximum transmit power of channel number 128 (869.2 MHz) and 251 (893.8 MHz) was set according to section 1.

2.5.3 Test configuration

The test configuration used is described in the block diagram in section 2.1.4 (page 6, Fig. 1).

2.5.4 Measurement procedure and results

The occupied bandwidth was determined for each of the test frequencies listed in the table below. See the spectral plots included on pages 29 – 34 for details. The 99% power bandwidth was determined with the spectrum analyzer. The following table summarizes the measurement results:

GMSK modulation:

Carrier Test Frequency [MHz]	Occupied Bandwidth [kHz]	Results
869.2	244.5	compliant
869.4	248.5	compliant
881.6	248.5	compliant
893.6	252.5	compliant
893.8	252.5	compliant

8PSK modulation:

Carrier Test Frequency [MHz]	Occupied Bandwidth [kHz]	Results
869.2	248.5	compliant
869.4	248.5	compliant
881.6	248.5	compliant
893.6	240.5	compliant
893.8	244.5	compliant

The occupied bandwidth was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

2.6 Test No. 4: Spurious emissions at antenna terminals (§ 2.1051, § 2.1057, § 22.917)

2.6.1 Purpose

The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1051 in order to verify that any emissions are below the limits given by § 22.917 (a).

2.6.2 Limits

Compliance with § 22.917 (a) requires that any emission be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$ (P = transmitter power in Watts).

The compliance limit was calculated as per the following table:

GMSK modulation:

Mean transmitter output power	47.86 W (= 46.8 dBm)
Required attenuation	$43 + 10 \log_{10} 47.86 = 59.8$ dB
Mean transmitter output power – required attenuation = compliance limit	46.8 dBm – 59.8 dB = –13 dBm

8PSK modulation:

Mean transmitter output power	47.86 W (= 46.8 dBm)
Required attenuation	$43 + 10 \log_{10} 47.86 = 59.8$ dB
Mean transmitter output power – required attenuation = compliance limit	46.8 dBm – 59.8 dB = –13 dBm

2.6.3 EUT operation condition

The standard setup procedure as described in section 2.1.1 of this report was used. The maximum transmit power of channel number 128 (869.2 MHz) and 251 (893.8 MHz) was set according to section 1.

2.6.4 Test configuration

The test configuration used is described in the block diagram in section 2.1.4 (page 6, Fig. 1).

2.6.5 Measurement procedure and results

The measurements were performed in accordance with § 22.917 (b). The measurements were performed at selected carrier test frequencies. Refer to spectral plots included on pages 36 – 50 for details. According to § 2.1057, all emission including the fundamental frequency of the transceiver and all frequencies up to the 10th harmonic were investigated.

The following table summarizes the worst case detected emission levels (see screenshots on pages 36 – 50 for details). The external attenuation (cable loss of the set up) is already added in the results. It can be seen separately as the “Offset” value in the screenshots.

Note:
The offset value indicated on the spectral plots represents the external attenuation value that includes the fixed attenuator plus the cable loss.

GMSK modulation:

Frequency Marker Indication [MHz]	Indicated Power Level [dBm]	External Attn. [dB]	Worst Case Emission Level [dBm]	Compliance Limit [dBm]	Spectral Plot on Page:	Results
Carrier Test Frequency 869.2 MHz						
868.00	-73.2	-32.4	-40.8	-13.0	36	compliant
868.98	-48.1	-32.4	-15.7	-13.0	37	compliant
894.25	-99.0	-32.4	-66.6	-13.0	38	compliant
1026.62	-79.6	-32.4	-47.2	-13.0	39	compliant
6983.97	-75.6	-32.4	-43.2	-13.0	40	compliant
Carrier Test Frequency 881.6 MHz						
868.00	-80.5	-32.4	-48.1	-13.0	41	compliant
868.59	-97.2	-32.4	-64.8	-13.0	42	compliant
894.36	-97.5	-32.4	-65.1	-13.0	43	compliant
2400.44	-79.8	-32.4	-47.4	-13.0	44	compliant
6903.81	-74.8	-32.4	-42.4	-13.0	45	compliant
Carrier Test Frequency 893.8 MHz						
817.67	-81.5	-32.4	-49.1	-13.0	46	compliant
868.39	-98.5	-32.4	-66.1	-13.0	47	compliant
894.02	-48.8	-32.4	-16.4	-13.0	48	compliant
2441.57	-79.6	-32.4	-47.2	-13.0	49	compliant
6593.19	-74.9	-32.4	-42.5	-13.0	50	compliant

Note:
The offset value indicated on the spectral plots represents the external attenuation value that includes the fixed attenuator plus the cable loss.

8PSK modulation:

Frequency Marker Indication [MHz]	Indicated Power Level [dBm]	External Attn. [dB]	Worst Case Emission Level [dBm]	Compliance Limit [dBm]	Spectral Plot on Page:	Results
Carrier Test Frequency 869.2 MHz						
868.00	-71.5	-32.4	-39.1	-13.0	36	compliant
868.98	-47.3	-32.4	-14.9	-13.0	37	compliant
894.36	-99.7	-32.4	-67.3	-13.0	38	compliant
2425.12	-79.2	-32.4	-46.8	-13.0	39	compliant
6953.91	-75.1	-32.4	-42.7	-13.0	40	compliant
Carrier Test Frequency 881.6 MHz						
847.17	-81.2	-32.4	-48.8	-13.0	41	compliant
868.44	-97.7	-32.4	-65.3	-13.0	42	compliant
894.68	-97.6	-32.4	-65.2	-13.0	43	compliant
2622.56	-79.7	-32.4	-47.3	-13.0	44	compliant
6583.17	-75.4	-32.4	-43.0	-13.0	45	compliant
Carrier Test Frequency 893.8 MHz						
786.43	-81.5	-32.4	-49.1	-13.0	46	compliant
868.64	-97.8	-32.4	-65.4	-13.0	47	compliant
894.01	-54.0	-32.4	-21.6	-13.0	48	compliant
2425.12	-79.2	-32.4	-46.8	-13.0	49	compliant
6893.79	-74.7	-32.4	-42.3	-13.0	50	compliant

The measured conducted emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

2.7 Test No. 5: Field strength of spurious radiation (§ 2.1053, § 2.1057, § 22.917)

2.7.1 Purpose

The measurement of spurious radiated emissions was performed pursuant to § 2.1053 and § 2.1057 to verify that the field strength of any spurious emissions radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements are attenuated below the transmitter power P by at least 43 + 10 $\log_{10}$ (P in Watts) dB as is required by § 22.917 (a).

2.7.2 Limits

Compliance with § 22.917 (a) requires that all spurious emissions be attenuated below the transmitter power by at least 43 + 10 $\log_{10}$ P (P = rated maximum transmitter output power in Watts).

The compliance limit was calculated as per the following table:

GMSK modulation:

Rated maximum transmitter output power	47.86 W (= 46.8 dBm)
Required attenuation	43 + 10 $\log_{10}$ 47.86 = **59.8** dB

8PSK modulation:

Rated maximum transmitter output power	47.86 W (= 46.8 dBm)
Required attenuation	43 + 10 $\log_{10}$ 47.86 = **59.8** dB

According to § 2.1057, all emissions to the 10th harmonic were investigated.

2.7.3 EUT operation condition

The EUT was configured and operating with its maximum number of TRX. All carriers were set to the maximum power level to ensure the maximum emission amplitudes during all measurements. The radiated spurious emissions were determined for three selected carrier test frequencies, according to section 2.1.2. During all testing, the EUT's RF output power was terminated into a non-radiating 50 Ω dummy load.

2.7.4 Test configuration

The measurements (scans) were conducted for BS-240XLU II. The measurements were performed in the anechoic chamber at the Siemens AG EMC Center, Hofmannstraße 51, 81359 Munich, Germany. The radiated test site complies with the site attenuation requirements listed in ANSI C63.4 1992 and is listed with the FCC.

The test antenna was positioned at a distance of 3 m from the EUT. Photographs of the EUT in the anechoic chamber are shown on page 52 of this measurement report.

2.7.5 Measurement procedure

For maximizing the radiated spurious emission measured levels the EUT was rotated 360°. The antenna height was adjusted between 1 m and 4 m. Both, horizontal and vertical polarizations were investigated.

To verify that all spurious emissions are compliant to the limits specified in § 22.917(a), the substitution method described in the ANSI/TIA/EIA-603-1992 document was used. Initially the EUT's spurious emission frequencies and field-strength values were measured and recorded. The measured, maximized field strength values were then used as the references levels for dipole substitution measurements.

For substitution measurements the EUT was removed and replaced with a signal generator and a transmitting antenna. TIA/EIA-603 requires that all substitution measurement transmissions have be done using a "dipole" antenna, as the reference antenna. As per TIA/EIA-603, corrections were done to equate the results to a dipole antenna. Using the same measurement techniques listed above (for maximizing), the signal generators output power was adjusted until the initial spurious emission reference levels were matched. The signal generator's indicated output power level was then recorded and corrected to an equivalent level at the transmitting antenna's input connector.

To determine compliance with the FCC Rules, the corrected dipole substitution powers were then set into relation to the EUT's (transmitter) power, measured at the antenna connector.

2.7.6 Measurement results & limits

Worst case detected emission levels are reported in the following table (refer to spectral plots included on pages 53 – 56 for details). The antenna factor and cable loss is according to the manufacturer's specification.

GMSK modulation:

Spurious Emission Frequency	Spurious Emission Reference Field Strength	Signal Generator Output	Power at dipole antenna[1]	Maximum Transmitter Output Power at the Antenna Port	Spurious Emissions in reference to Output Power of EUT[2]	Limit	Results
[MHz]	[dBµV/m]	[dBm]	[dBm]	[dBm]	[dBc]	[dB]	
4765.0	55.80	-53.0	-58.50	46.8	105.3	59.8	compliant
11778.5	56.70	-53.0	-57.65	46.8	104.5	59.8	compliant
13311.0	64.40	-43.0	-43.25	46.8	90.1	59.8	compliant
17978.5	65.80	-42.0	-42.45	46.8	89.3	59.8	compliant

[1] Power at Dipole Antenna = Signal Generator Output – cable loss + correction factor antenna gain
[2] [dBc] = Maximum Transmitter Output Power [dBm] - Power at dipole antenna [dBm]

8PSK modulation:

Spurious Emission Frequency	Spurious Emission Reference Field Strength	Signal Generator Output	Power at dipole antenna[3]	Maximum Transmitter Output Power at the Antenna Port	Spurious Emissions in reference to Output Power of EUT[4]	Limit	Results
[MHz]	[dBµV/m]	[dBm]	[dBm]	[dBm]	[dBc]	[dB]	
4765.0	55.80	-53.0	-58.50	46.8	105.3	59.8	compliant
11778.5	56.70	-53.0	-57.65	46.8	104.5	59.8	compliant
13311.0	64.40	-43.0	-43.25	46.8	90.1	59.8	compliant
17978.5	65.80	-42.0	-42.45	46.8	89.3	59.8	compliant

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

[3] Power at Dipole Antenna = Signal Generator Output – cable loss + correction factor antenna gain
[4] [dBc] = Maximum Transmitter Output Power [dBm] - Power at dipole antenna [dBm]

2.8 Test No. 6: Frequency stability (§ 2.1055, § 22.355)

2.8.1 Purpose

Frequency stability measurements were performed to verify that the frequency deviation of the emission stays within the licensee's frequency block under extreme temperature conditions (-5°C to +50°C) according to § 2.1055.

2.8.2 Limits

According to § 22.355, the frequency tolerance of the carrier frequency of a base station (frequency range 821-896 MHz) must not exceed 1.5 ppm.

2.8.3 EUT operation condition

The EUT was configured and powered up with its maximum number of TRX. All carriers were set to the maximum power level to ensure the maximum emission amplitudes during all measurements.
The supply voltage of -48 V DC was kept constant.
The supply voltage is measured at the power supply terminals of the EUT.

2.8.4 Test configuration

The measurements were conducted with a BS-240XLU II.
The EUT was controlled by a BSC simulator via the serial Abis Link and connected to a mobile communication tester (CMU300, Rohde&Schwarz) via a high power 20 dB attenuator. The attenuator was used to protect the input of the measurement equipment from high RF power levels.
The EUT was operated and tested in a climatic chamber.
The measurements were performed at Siemens AG, Center for Quality Engineering, Hofmannstr. 50, 81359 Munich, Germany.
A complete list of the measurement equipment is included on page 21 of this measurement report.

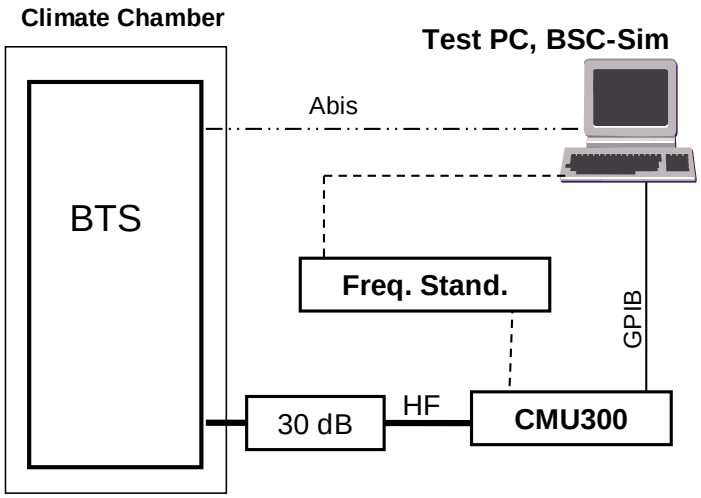

Fig. 2 – Measurement Test Configuration

2.8.5 Measurement procedure

The center frequency deviation of the highest and lowest test frequency was measured at ambient temperature levels from -5°C to +50°C in intervals of not more than 10°C.
At each temperature level, the frequency was measured over a time period of 10 minutes, taking one measurement value every minute.

2.8.6 Measurement results

The following table includes the worst case detected frequency deviations. For complete measurement data see plots on pages 58 – 59. The BS-240XLU II is designed for indoor locations. Therefore the EUT does not work below a temperature of –5°C, no RF signals were measured at the antenna port.

GMSK modulation:

Ambient Temp. [°C]	Frequency Deviation @ -48V [ppm]	Manufacturer's Specification [ppm]	Results
-5	0.006	1.5	compliant
0	0.007	1.5	compliant
+10	0.007	1.5	compliant
+20	0.008	1.5	compliant
+30	0.006	1.5	compliant
+40	0.007	1.5	compliant
+50	0.007	1.5	compliant

8PSK modulation:

Ambient Temp. [°C]	Frequency Deviation @ -48V [ppm]	Manufacturer's Specification [ppm]	Results
-5	0.007	1.5	compliant
0	0.007	1.5	compliant
+10	0.008	1.5	compliant
+20	0.007	1.5	compliant
+30	0.007	1.5	compliant
+40	0.007	1.5	compliant
+50	0.007	1.5	compliant

A pseudo random bit sequence was applied to the modulator during all testing. No variation of the frequency deviation due to keying was observed. Also, no variation of the frequency deviation due to the EUT's heater element was observed at any temperature level (refer to measurement data above).

The measured frequency stability was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

2.9 Test No. 7: Slow frequency hopping

2.9.1 Introduction

Slow frequency hopping (SFH) is a feature of GSM transceiver systems used to improve the signal quality under fading conditions. When SFH is activated, the carrier frequency is shifted to a different value on a timeslot per timeslot basis. This is depicted in the figure below (carrier test frequencies 869.2 MHz, 881.6 MHz, and 893.8 MHz).

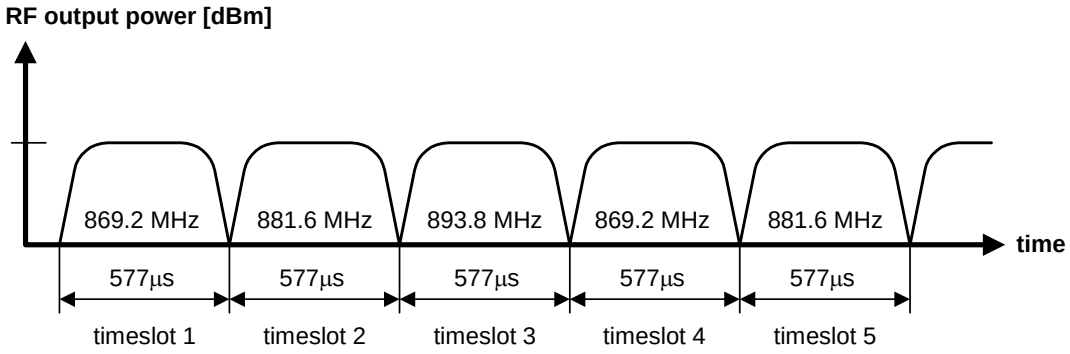

Fig. 3 – Slow frequency hopping (SFH) comprising 3 carrier test frequencies (869.2 MHz, 881.6 MHz, and 893.8 MHz).

SFH allows only one carrier per transmitter being activated at a time. This ensures that no intermodulation products are produced.

2.9.2 Purpose

These measurements were performed to verify that under SFH operating conditions, spurious emissions due to intermodulation products and periodically shifting the carrier frequency were not produced above the compliance level required under § 2.1051 of the FCC rules.

2.9.3 EUT operation condition

The standard setup procedure as described in section 2.1.1 of this report was used and the EUT was configured with two TRX. The SFH operating mode was switched on throughout the measurements. Three hopping test frequencies were measured in accordance with section 2.1.2. Please refer to Fig. 3 for the hopping scheme.

2.9.4 Test configuration

The test configuration used is described in the block diagram in section 2.1.4 (page 6, Fig. 1).

2.9.5 Measurement procedure

A spectrum analyzer (FSIQ26, Rohde&Schwarz) was used to verify that all emissions are below the permissible limit.

2.9.6 Measurement results

SFH did not cause any detectable emissions above the compliance limits required by the FCC rules. The following table summarizes the worst case detected emission levels.

Note:
The offset value indicated on the spectral plots represents the external attenuation value that includes the fixed attenuator plus the cable loss.

GMSK modulation:

Frequency [MHz]	Indicated Power Level [dBm]	External Attenuation [dB]	Measured Power Level [dBm]	Compliance Limit [dBm]	Results
808.05	-59.9	-32.4	-27.5	-13.0	compliant
967.57	-66.4	-32.4	-34.0	-13.0	compliant
464.50	-85.4	-32.4	-53.0	-13.0	compliant

8PSK modulation:

Frequency [MHz]	Indicated Power Level [dBm]	External Attenuation [dB]	Measured Power Level [dBm]	Compliance Limit [dBm]	Results
855.75	-61.7	-32.4	-29.3	-13.0	compliant
858.95	-65.9	-32.4	-33.5	-13.0	compliant
826.49	-86.7	-32.4	-54.3	-13.0	compliant

The above listed emission levels were taken from measurements conducted using three different RBW (resolution bandwidth) settings (1 MHz, 300 kHz, and 3 kHz). Copies of the spectral plots can be found on pages 61 – 63.

It was verified through measurements that SFH does not cause any adverse effects on other parameters of the transmitter (RF power output, modulation characteristics, occupied bandwidth, spurious emissions, and frequency stability).

The measurement values were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

3 Measurement data and spectral plots

3.1 Part list of the RF measurement test equipment

No.	Item	Model	Serial Number	Test No.
1	Personal computer	Fujitsu Siemens SCENIC W600	YBES213379	1 ,2 ,3 ,4 , 7
2	Spectrum analyzer	Rohde & Schwarz FSIQ 26	825556/007	1 ,2 ,3 ,4 , 7
3	Atomic clock reference	Datum GmbH RubiSource 2000	187	1 ,2 ,3 ,4 , 7
4	Personal computer	Alternate	3E9999 7P**01 2762PC	5
5	Radio Communication Tester	Rohde & Schwarz	100059	5
6	Radio Communication Tester	Rohde & Schwarz	100060	5
7	Personal Computer	FSC	YBPJ014171	5
8	Personal Computer	FSC	YBPJ015303	5
9	Frequency Standard	Datum GmbH	150	5
10	test chamber	Siemens	-	5
11	antenna	Singer	0273	5
12	amplifier	miteq	909363	5
13	ESMI display section	R&S	849182/009	5
14	ESMI RF section	R&S	849937/003	5
15	controller	Deisel	100/503	5
16	antenna	SCIEN	100	5
17	antenna	Ailtech	2622	5
18	mast	Deisel	240/445	5
19	power supply	Siemens	-	5
20	antenna	Chase	1566	5
21	antenna	Emco	8906-3173	5
22	signal generator	R&S	832033/0006	5
23	Personal computer	Scenic 860	YBHE067914	6
24	Radio Communication Tester	CMU 300	100060	6
25	Radio Communication Tester	CMU 300	100175	6
26	Personal Computer	Laptop Lifebook E-7010	YBDC007725	6
27	Personal Computer	Laptop Lifebook E-7010	YBDC007722	6
28	Frequency Standard	MRT Telekom Rub. Freq. Normal	4202 / 001	6
29	DC Power Supply	1150-064	3002	6
30	DC Power Supply	1150-064	3102	6
31	Digital-AC/DC-Multimeter	HIO - K3284	647605	6

3.2 Spectral plots

3.2.1 Test No. 1: RF Power Output

Test No. 1: RF Power Output (Carrier Test Frequency = 869.2 MHz)

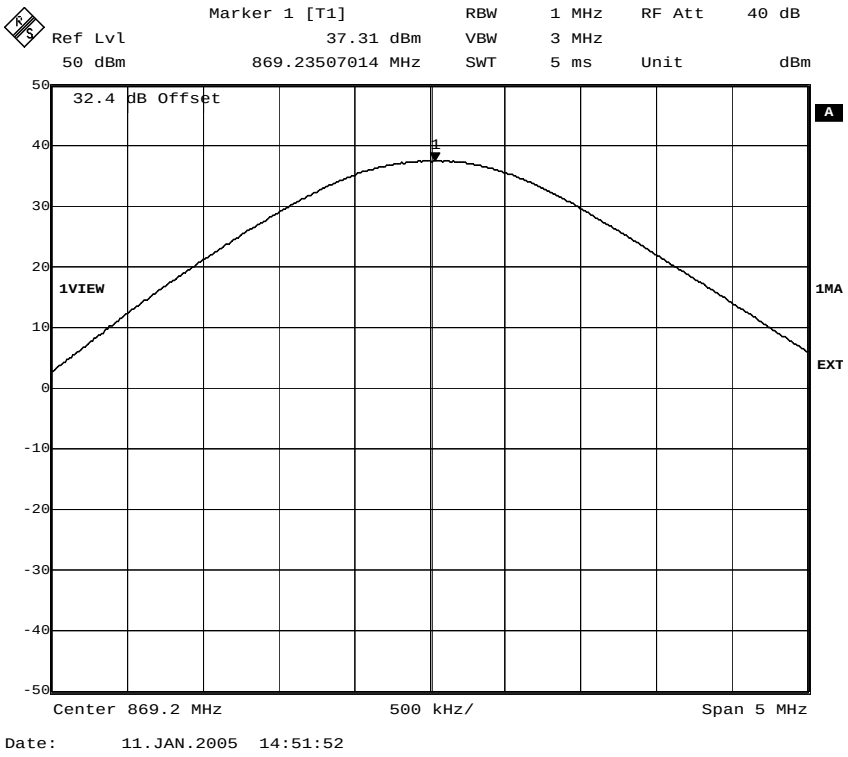

Fig. 4 – RF power at the antenna connector (GMSK modulation).

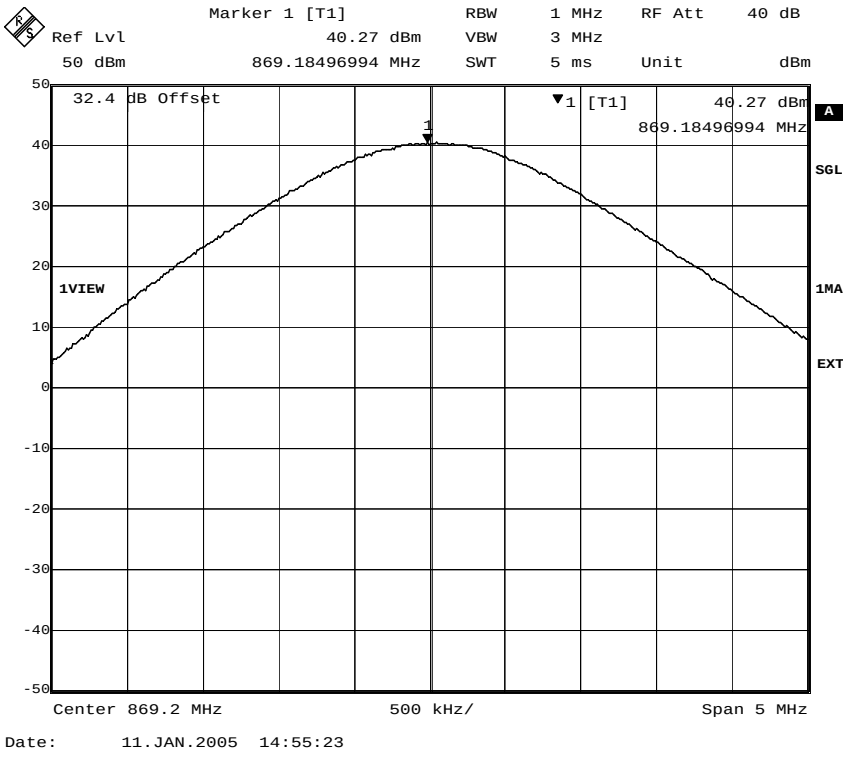

Fig. 5 – RF power at the antenna connector (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 1: RF Power Output (Carrier Test Frequency = 869.4 MHz)

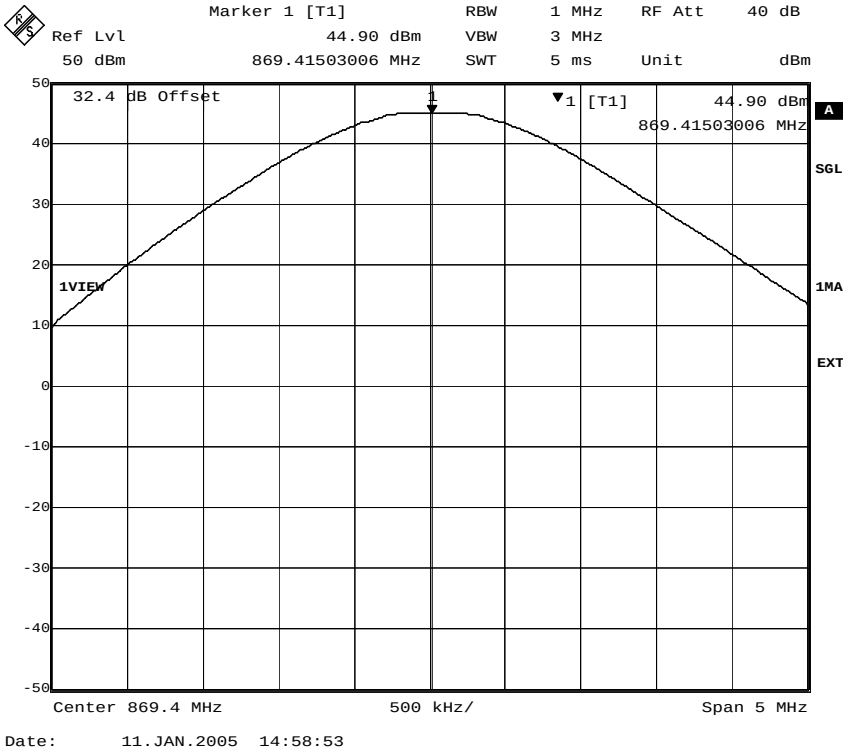

Fig. 6 – RF power at the antenna connector (GMSK modulation).

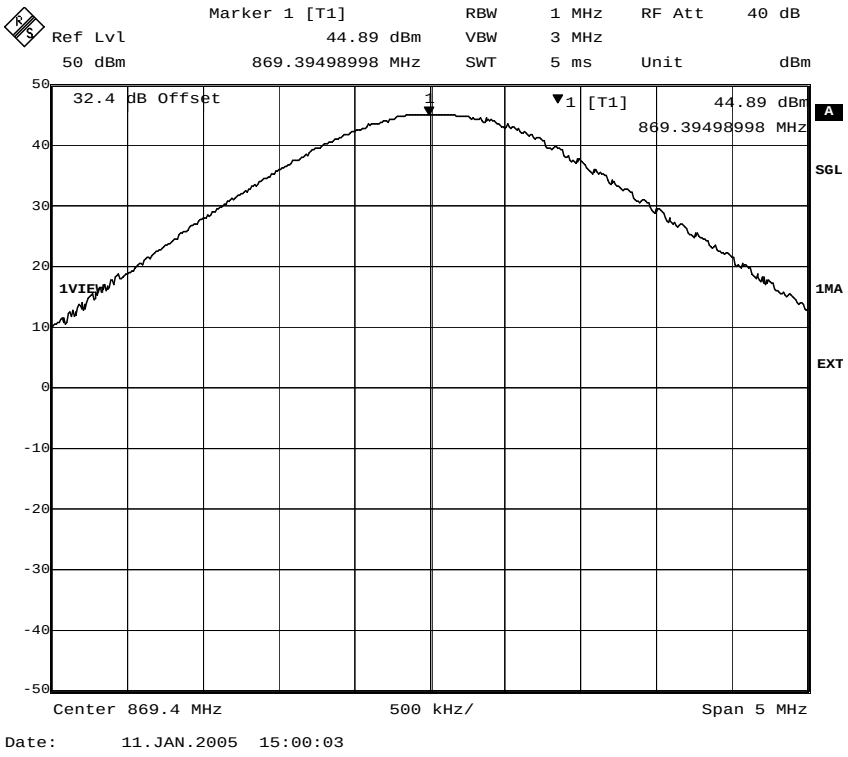

Fig. 7 – RF power at the antenna connector (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 1: RF Power Output (Carrier Test Frequency = 881.6 MHz)

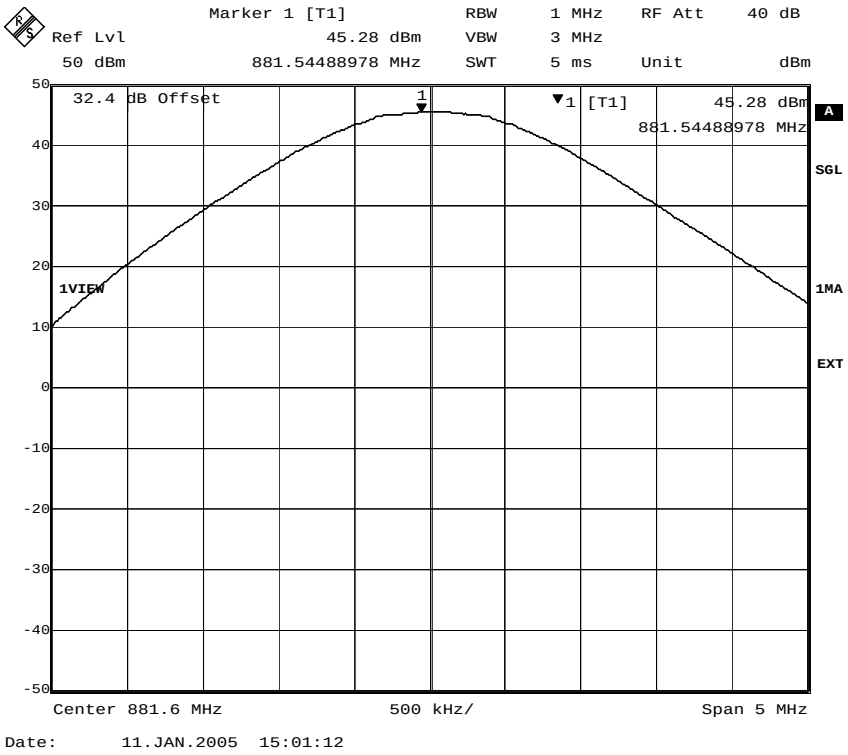

Fig. 8 – RF power at the antenna connector (GMSK modulation).

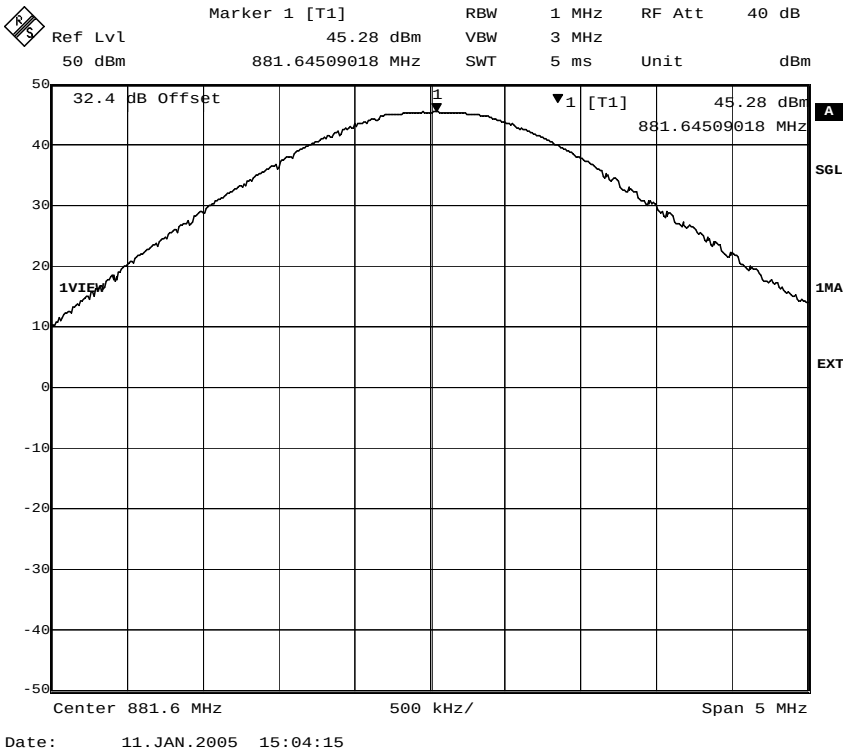

Fig. 9 – RF power at the antenna connector (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 1: RF Power Output (Carrier Test Frequency = 893.6 MHz)

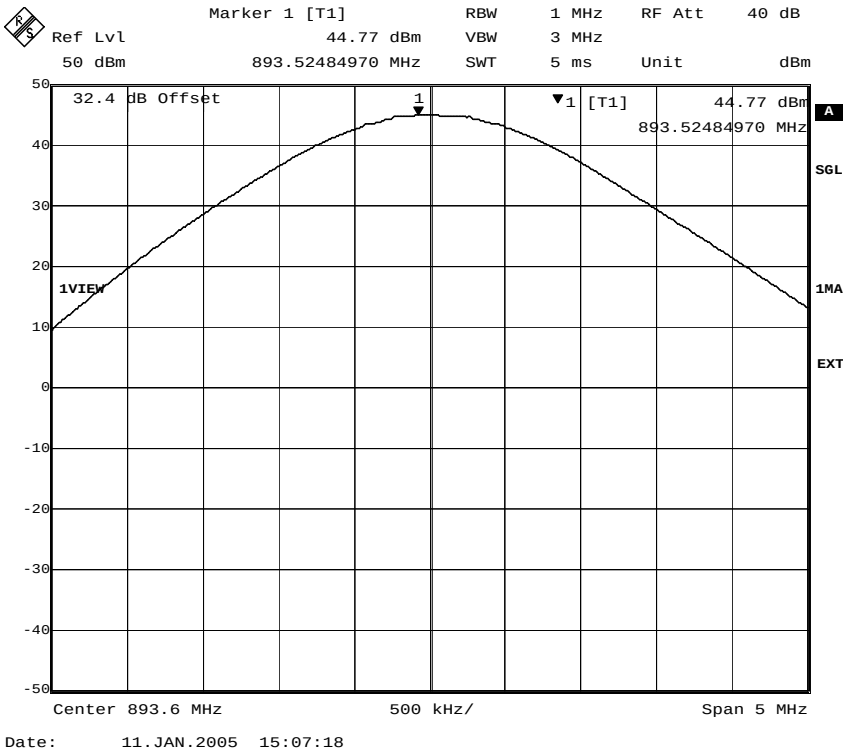

Fig. 10 – RF power at the antenna connector (GMSK modulation).

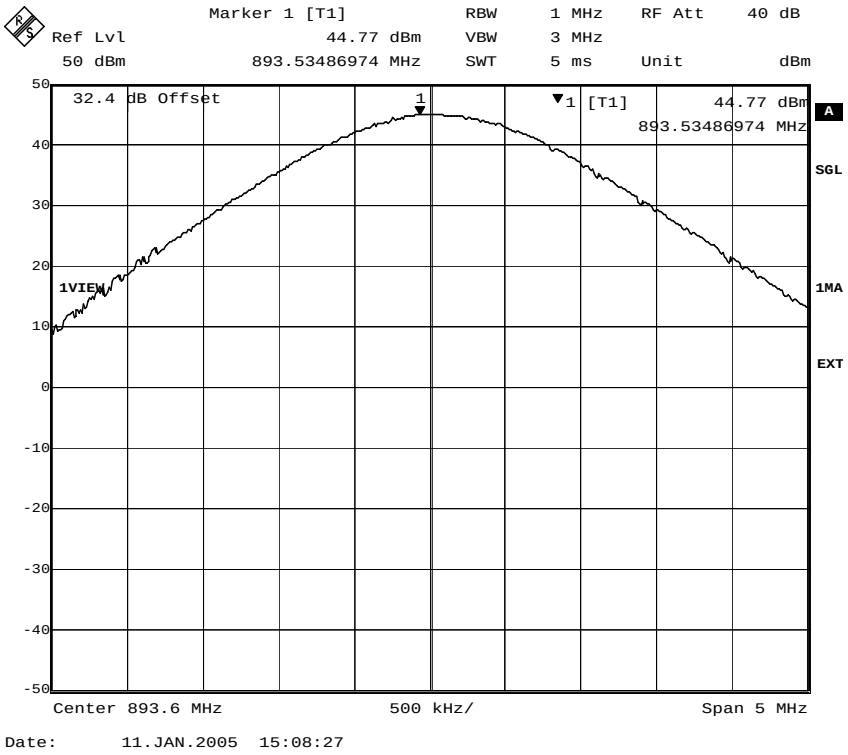

Fig. 11 – RF power at the antenna connector (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 1: RF Power Output (Carrier Test Frequency = 893.8 MHz)

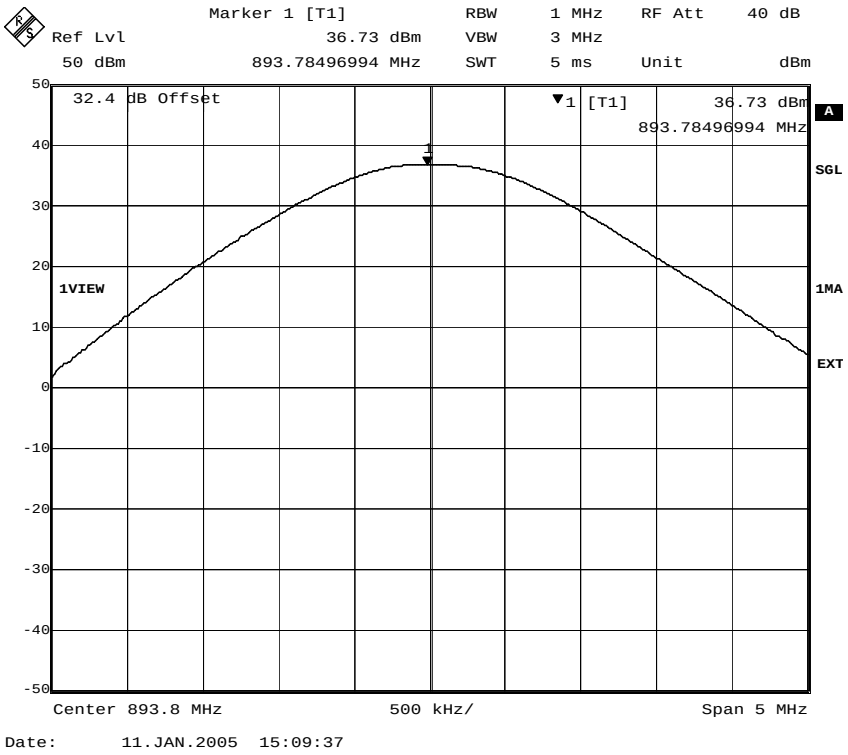

Fig. 12 – RF power at the antenna connector (GMSK modulation).

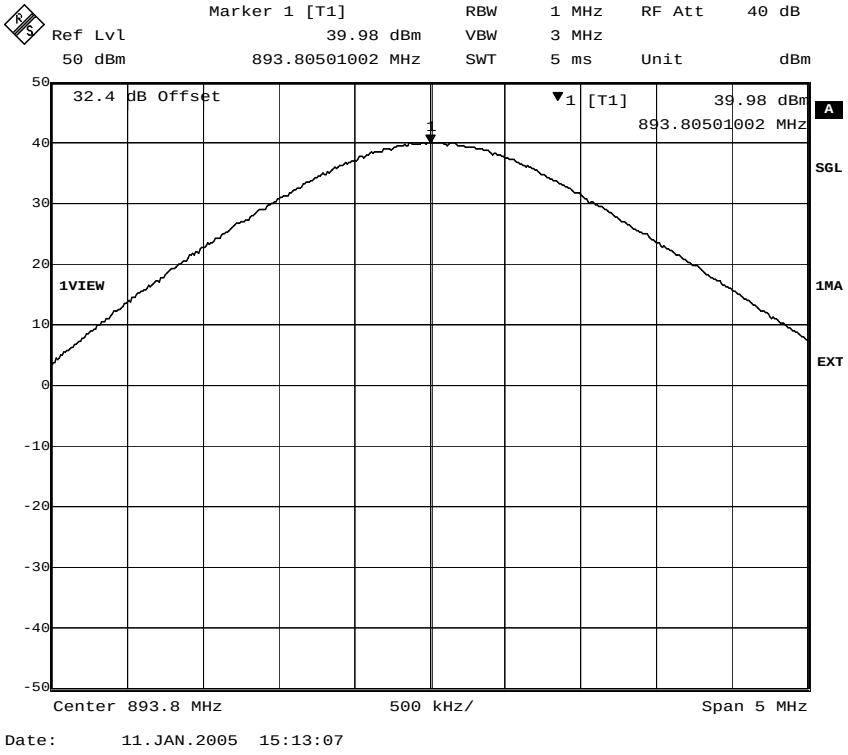

Fig. 13 – RF power at the antenna connector (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

3.2.2 Test No. 2: Modulation Characteristics

Test No. 2: Modulation Characteristics

No additional measurements are required for the modulation characteristics. Please refer to test no. 3, occupied bandwidth on page 10.

3.2.3 Test No. 3: Occupied Bandwidth

Test No. 3: Occupied Bandwidth (Carrier Test Frequency = 869.2 MHz)

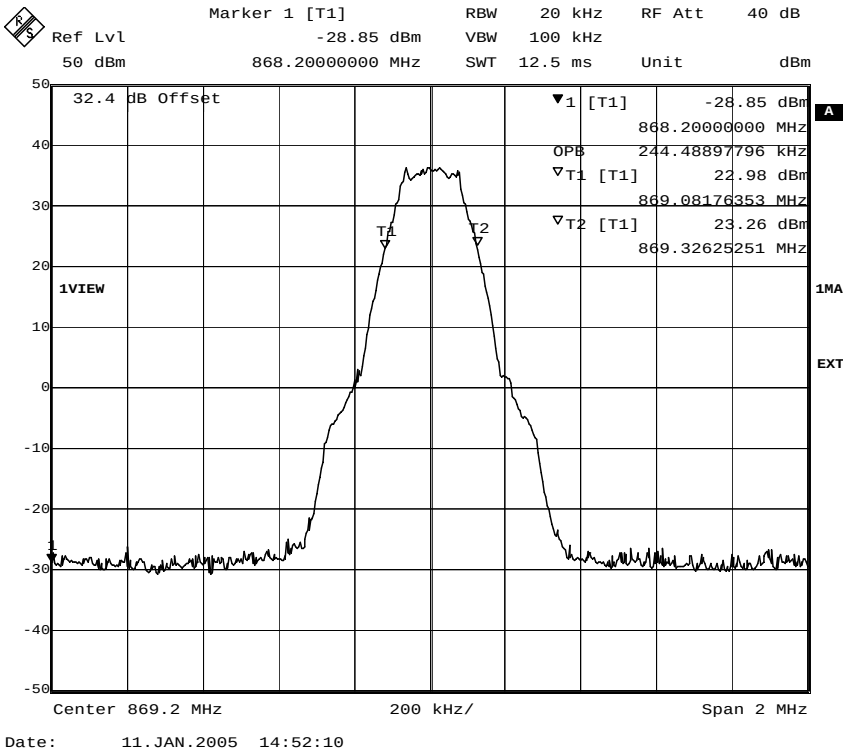

Fig. 14 – Occupied bandwidth (GMSK modulation).

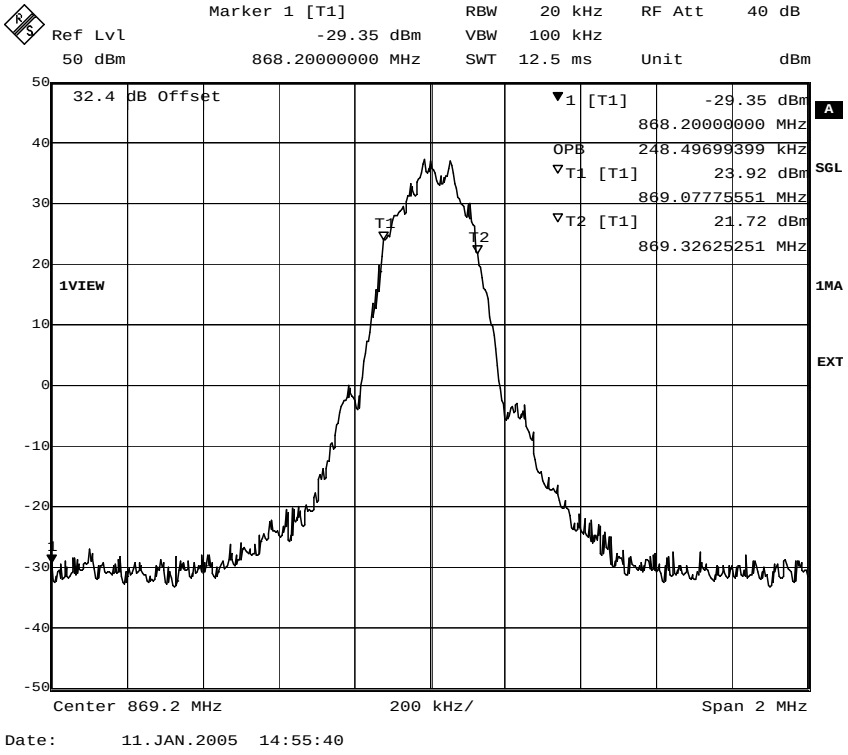

Fig. 15 – Occupied bandwidth (8PSK modulation).

Note: The external attenuation of 32.4 dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 3: Occupied Bandwidth (Carrier Test Frequency = 869.4 MHz)

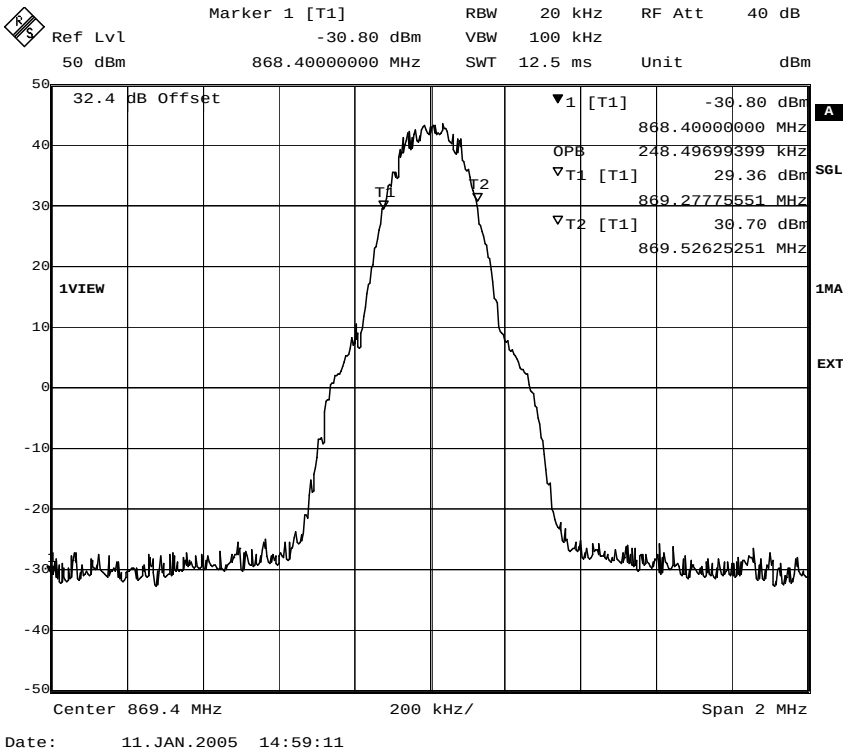

Fig. 16 – Occupied bandwidth (GMSK modulation).

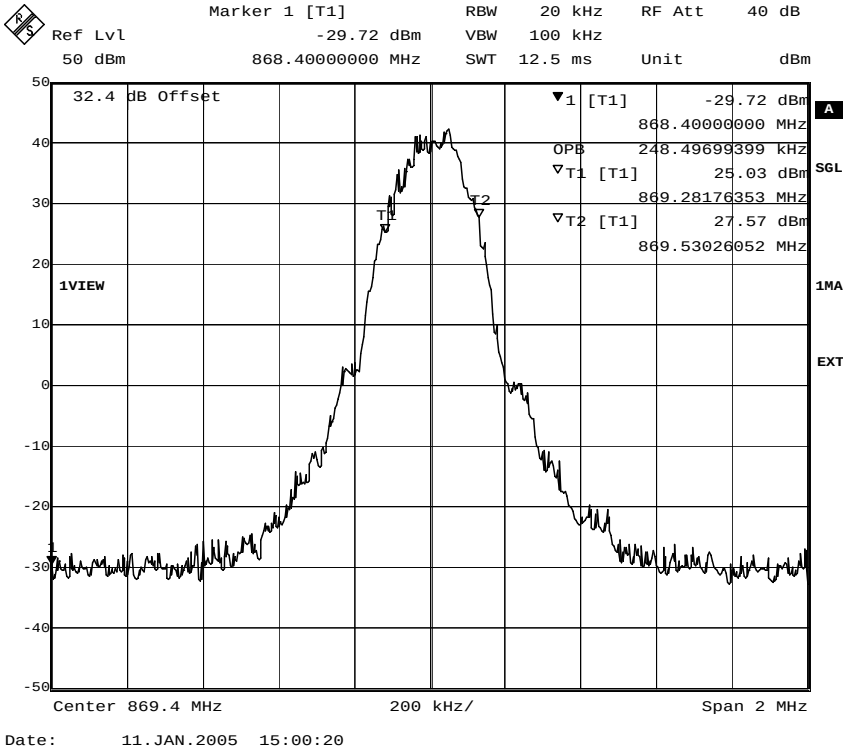

Fig. 17 – Occupied bandwidth (8PSK modulation).

Note: The external attenuation of 32.4 dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 3: Occupied Bandwidth (Carrier Test Frequency = 881.6 MHz)

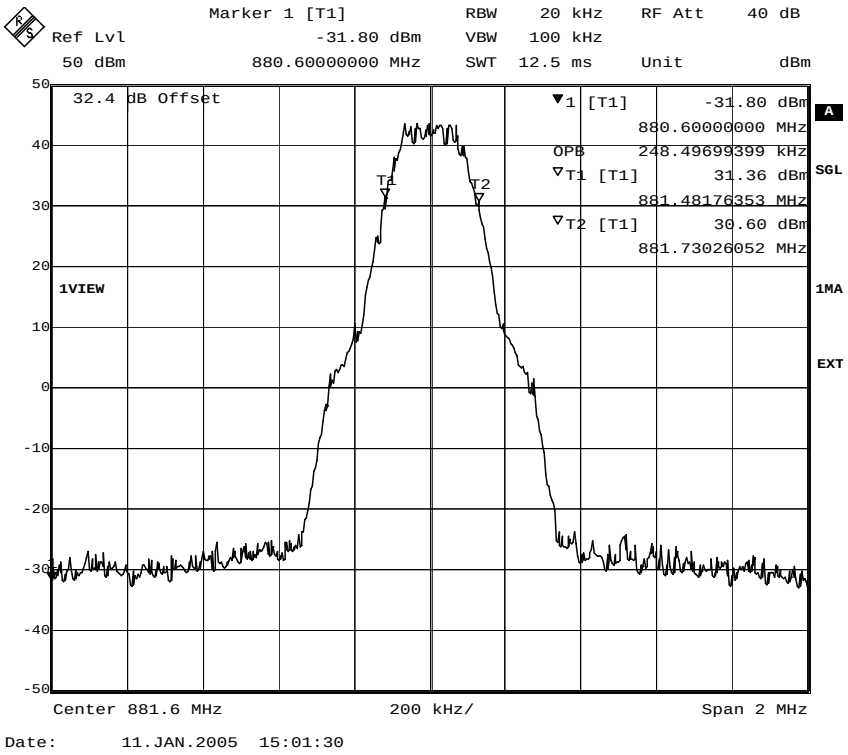

Fig. 18 – Occupied bandwidth (GMSK modulation).

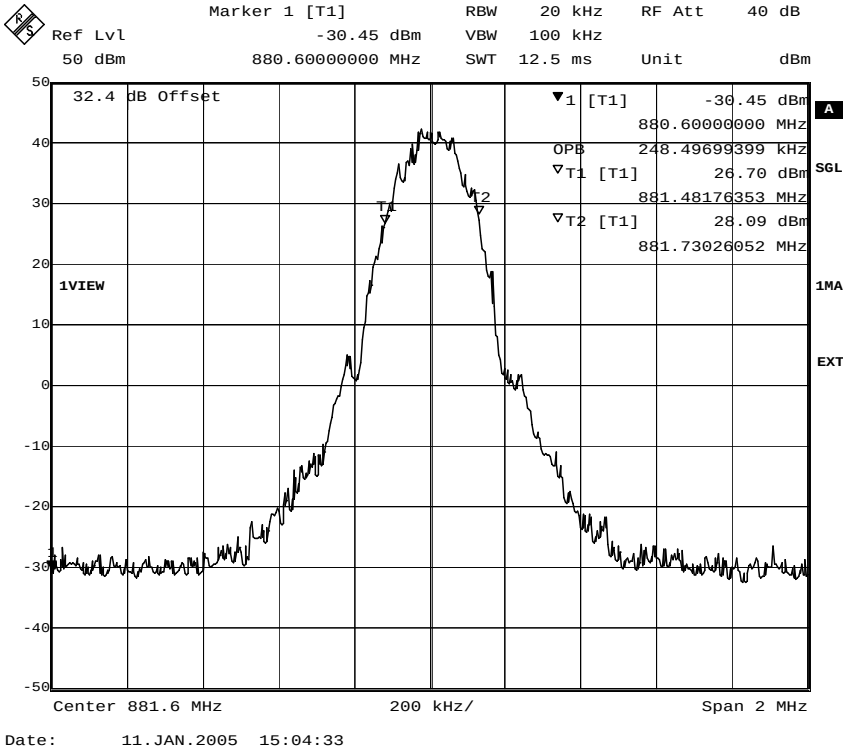

Fig. 19 – Occupied bandwidth (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 3: Occupied Bandwidth (Carrier Test Frequency = 893.6 MHz)

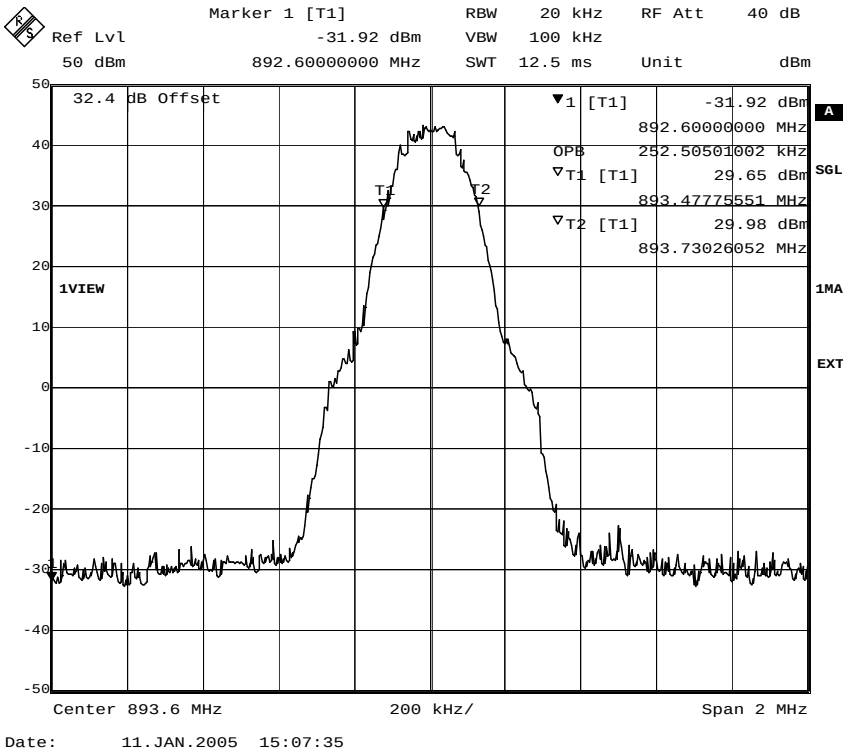

Fig. 20 – Occupied bandwidth (GMSK modulation).

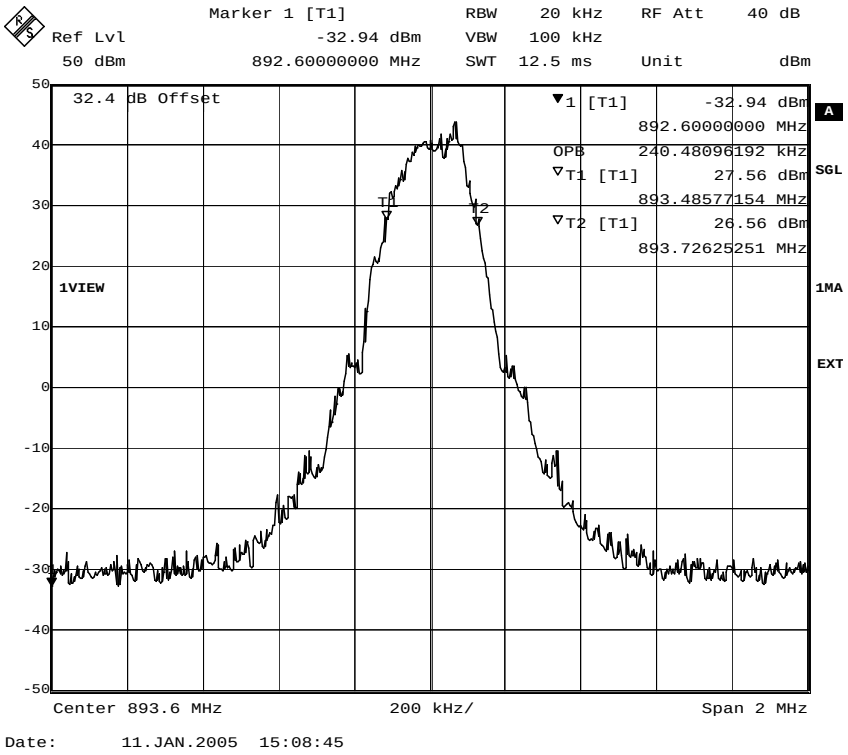

Fig. 21 – Occupied bandwidth (8PSK modulation).

Note: The external attenuation of 32.4 dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 3: Occupied Bandwidth (Carrier Test Frequency = 893.8 MHz)

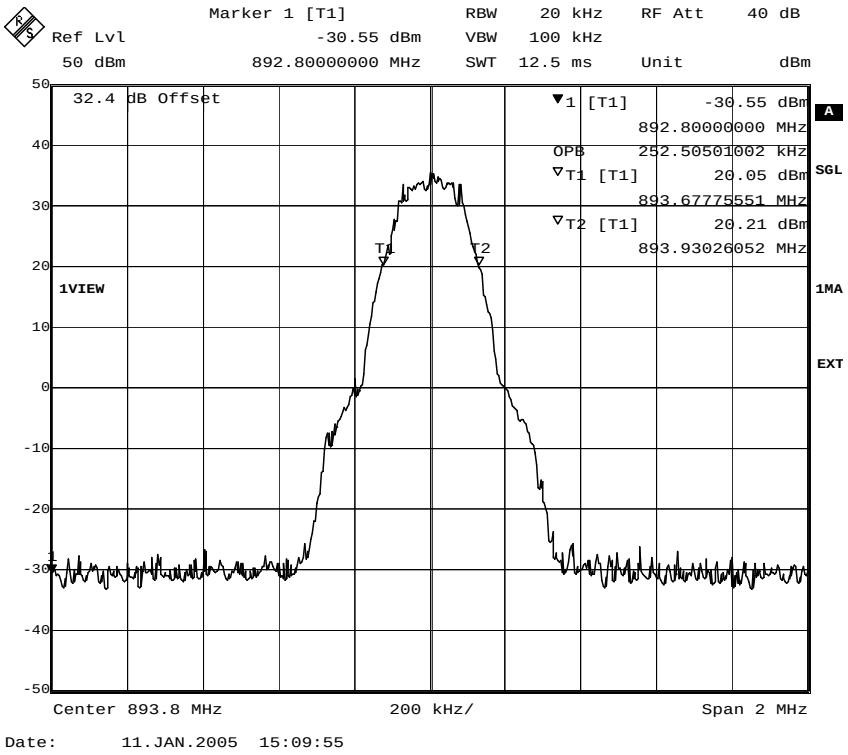

Fig. 22 – Occupied bandwidth (GMSK modulation).

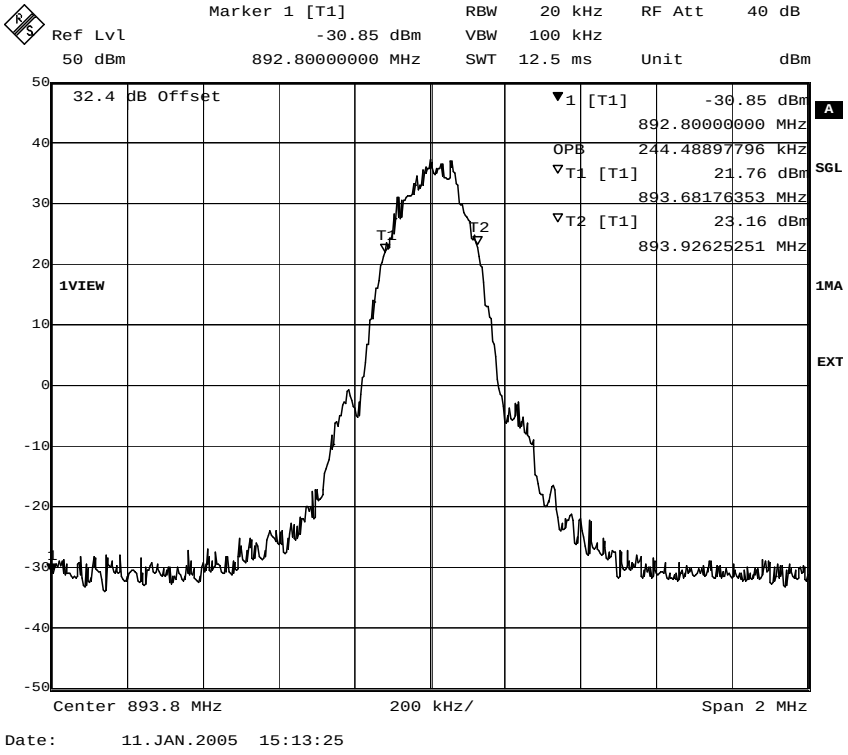

Fig. 23 – Occupied bandwidth (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

3.2.4 Test No. 4: Spurious Emissions at the Antenna Terminals

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 869.2 MHz)

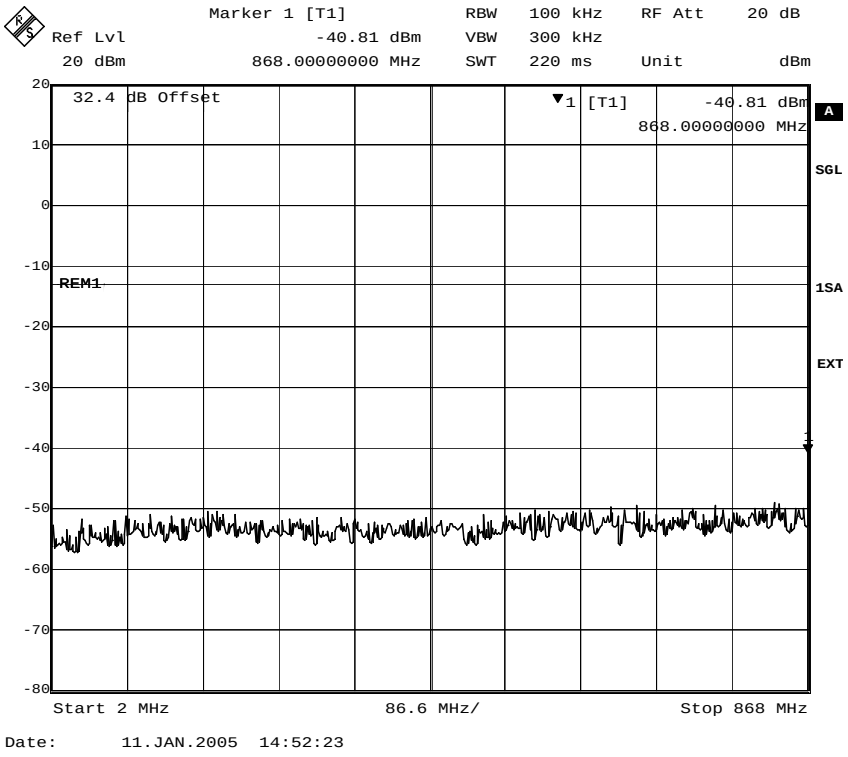

Fig. 24 – Spurious emissions in the frequency range 2 MHz – 868 MHz (GMSK modulation).

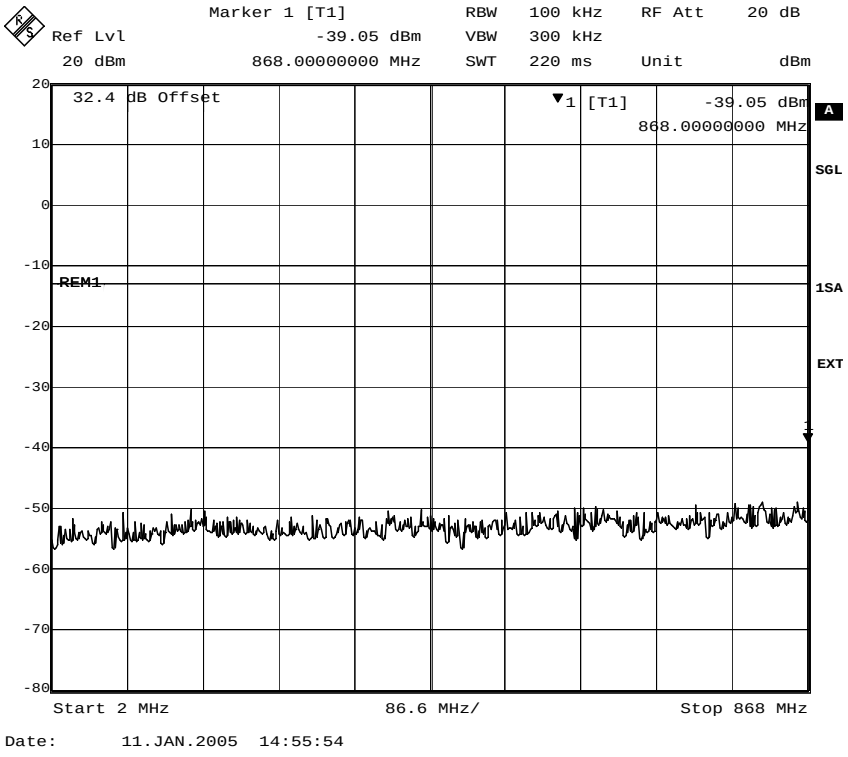

Fig. 25 – Spurious emissions in the frequency range 2 MHz – 868 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 869.2 MHz)

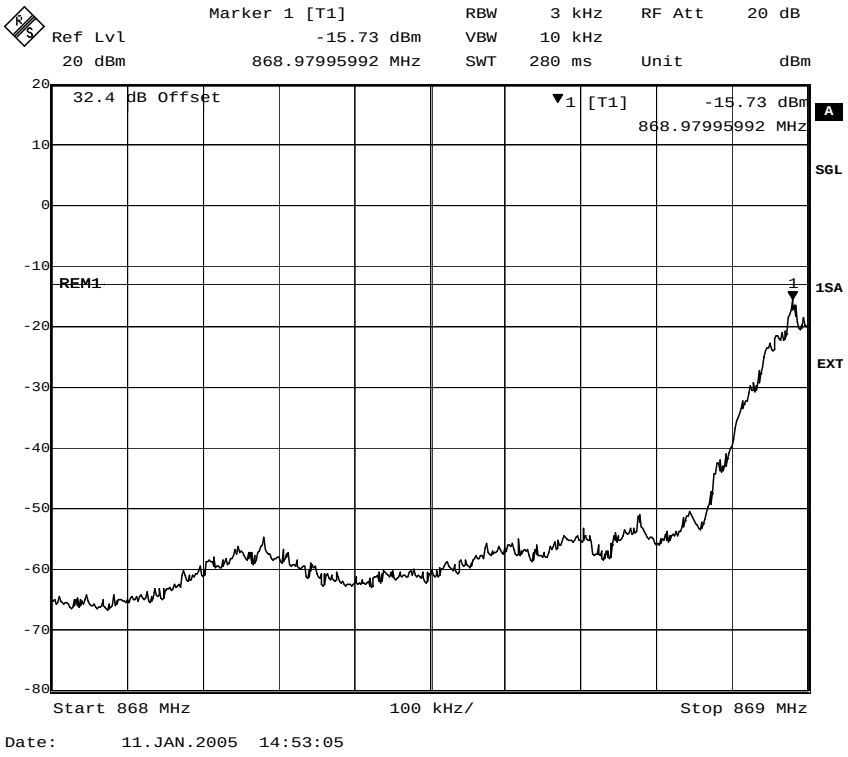

Fig. 26 – Spurious emissions in the frequency range 868 MHz – 869 MHz (GMSK modulation).

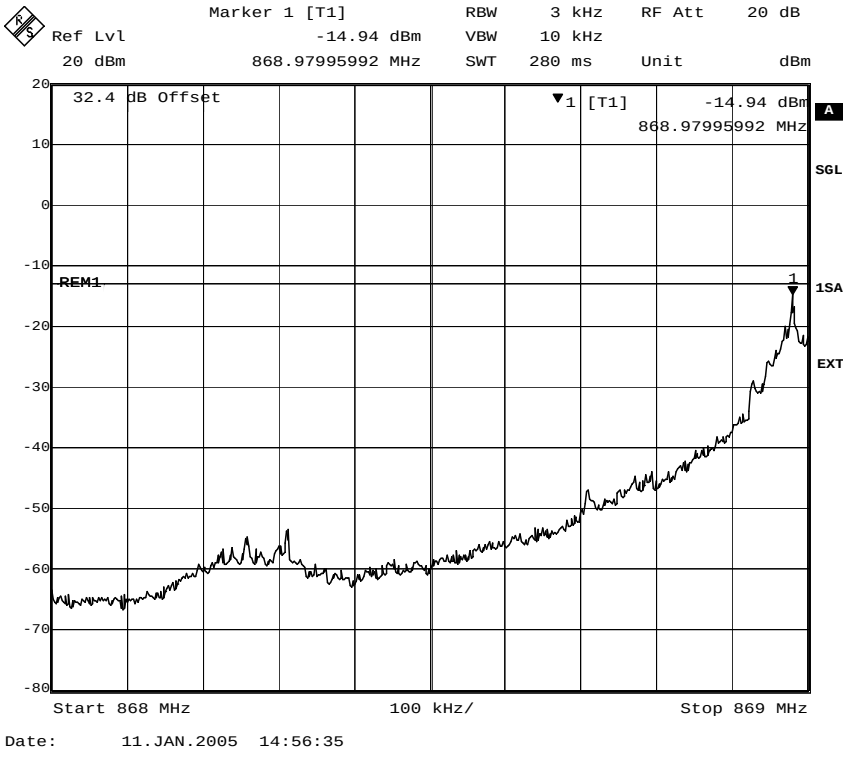

Fig. 27 – Spurious emissions in the frequency range 868 MHz – 869 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 869.2 MHz)

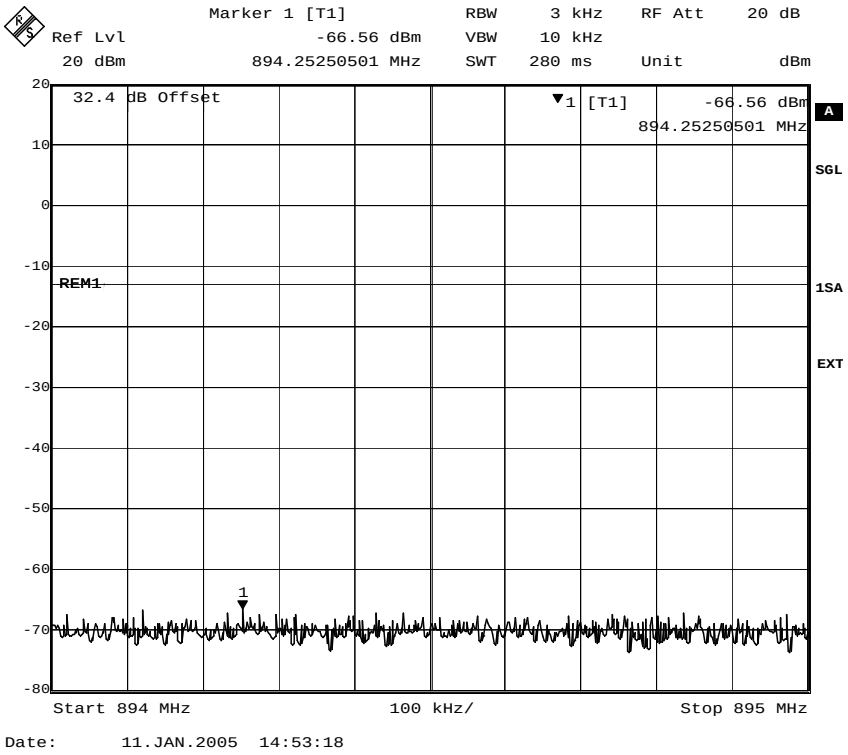

Fig. 28 – Spurious emissions in the frequency range 894 MHz – 895 MHz (GMSK modulation).

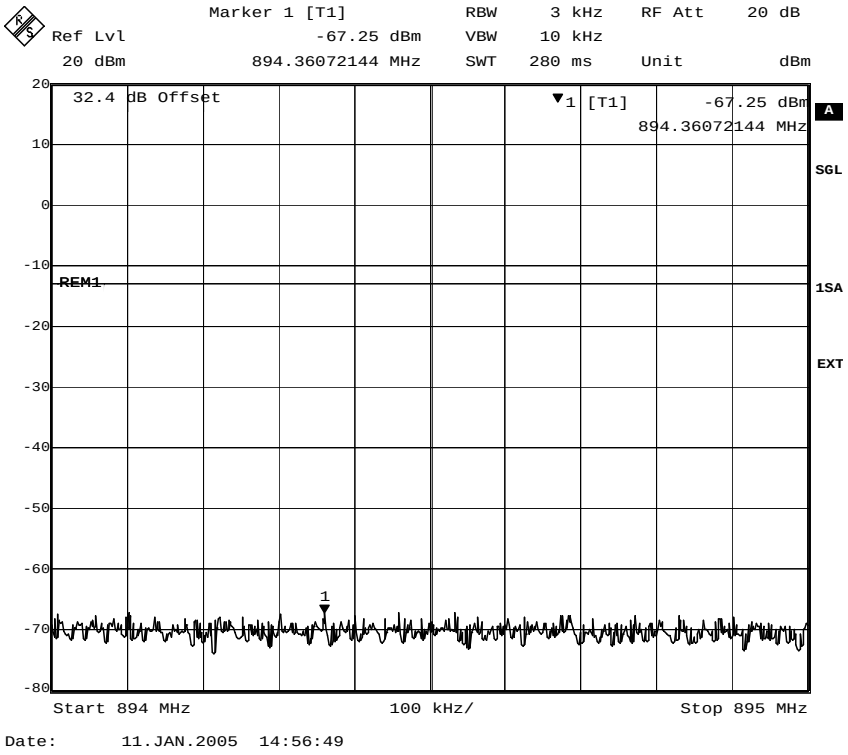

Fig. 29 – Spurious emissions in the frequency range 894 MHz – 895 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 869.2 MHz)

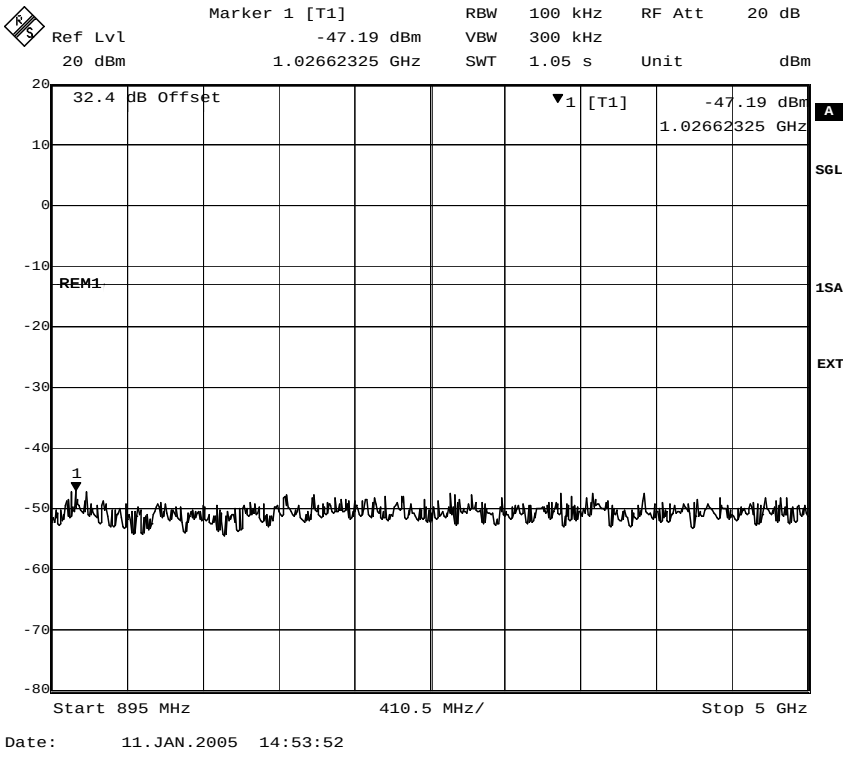

Fig. 30 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (GMSK modulation).

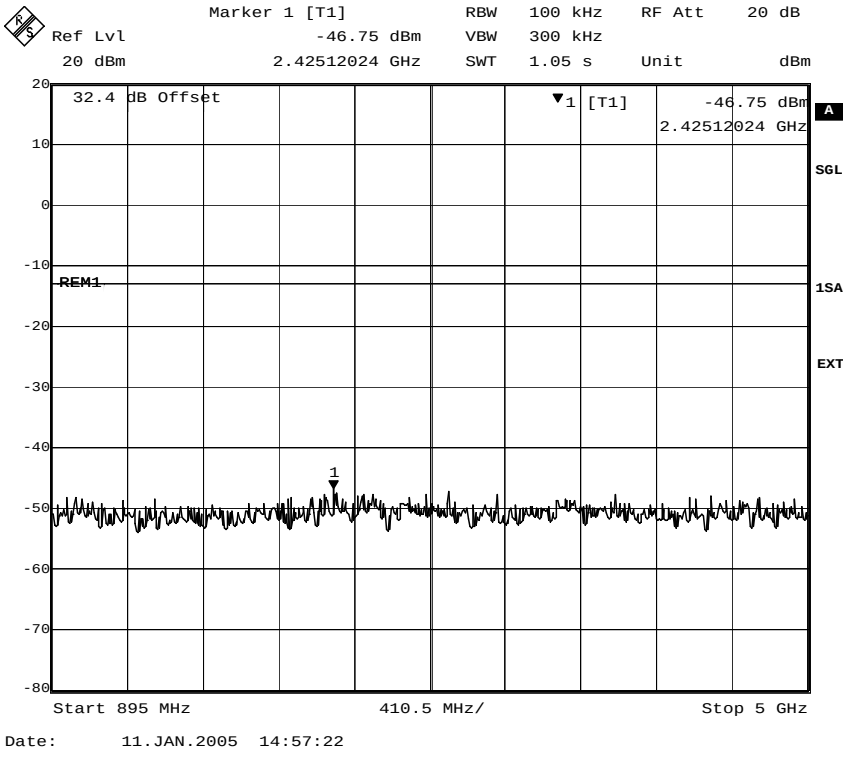

Fig. 31 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 869.2 MHz)

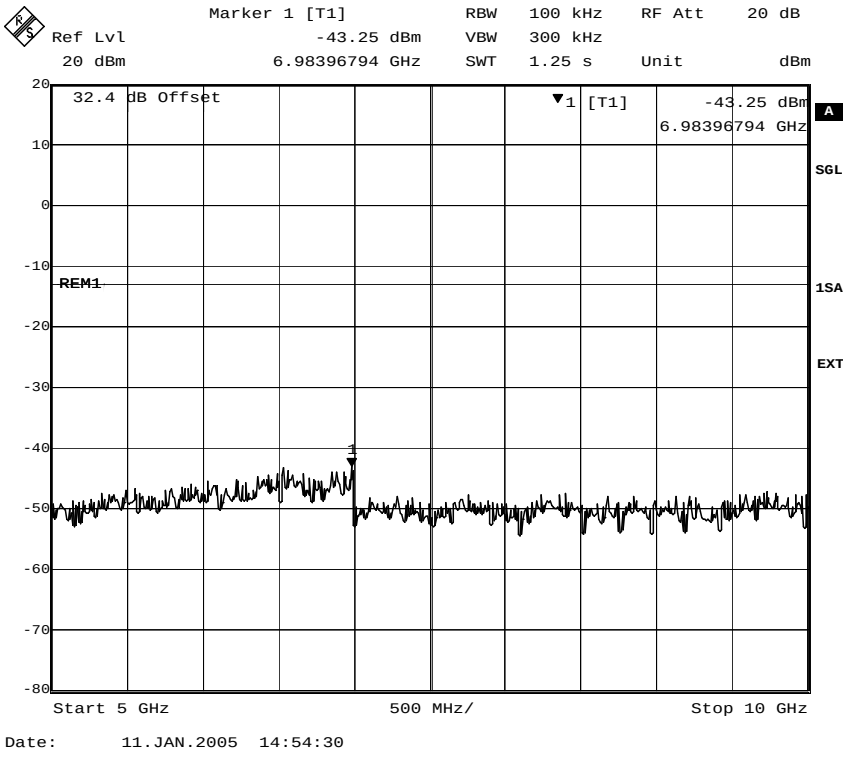

Fig. 32 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (GMSK modulation).

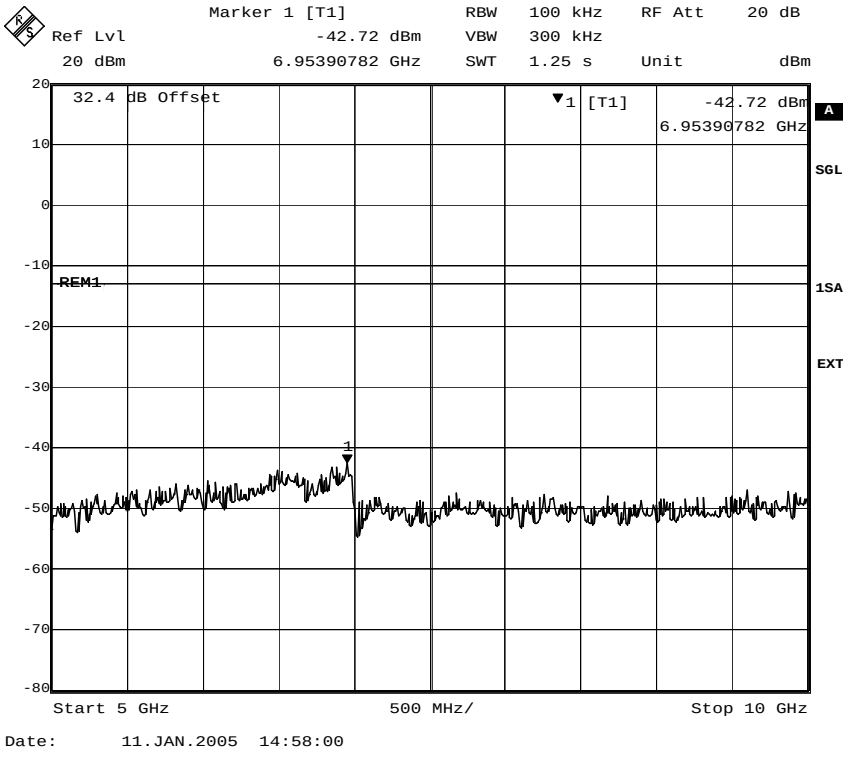

Fig. 33 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 881.6 MHz)

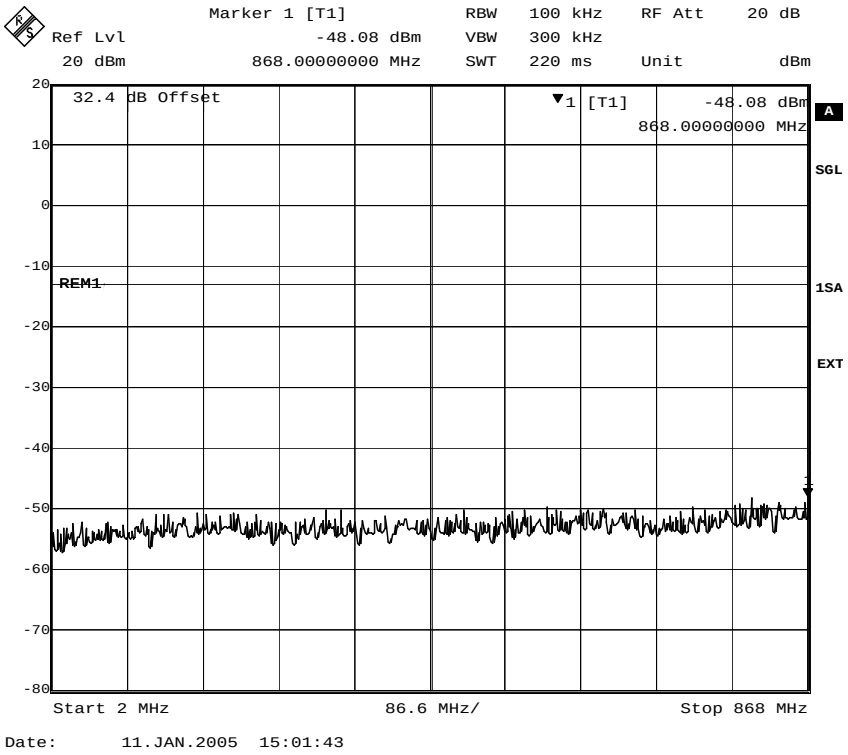

Fig. 34 – Spurious emissions in the frequency range 2 MHz – 868 MHz (GMSK modulation).

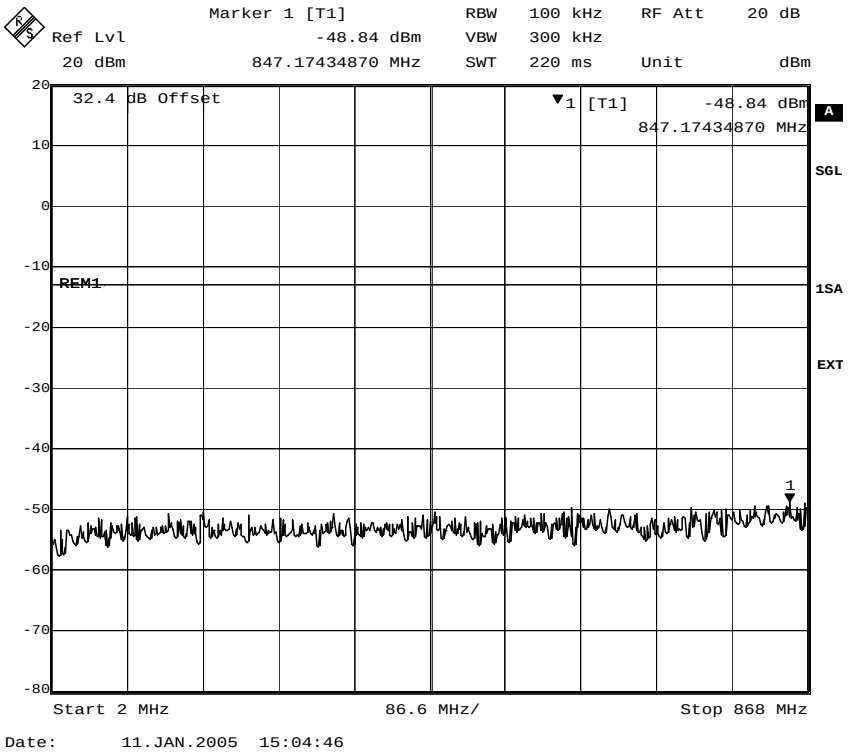

Fig. 35 – Spurious emissions in the frequency range 2 MHz – 868 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 881.6 MHz)

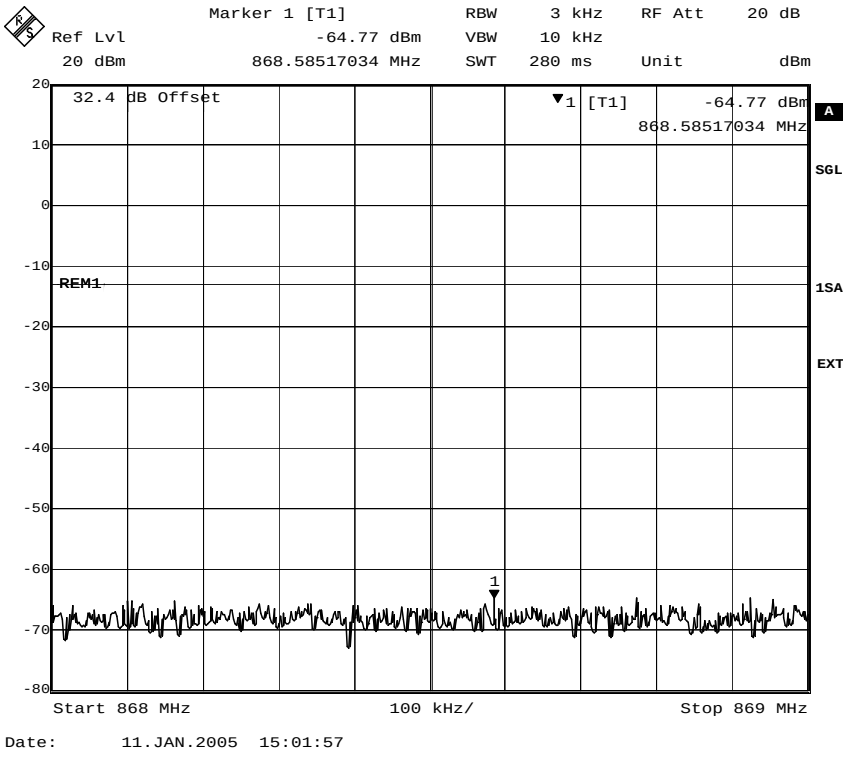

Fig. 36 – Spurious emissions in the frequency range 868 MHz – 869 MHz (GMSK modulation).

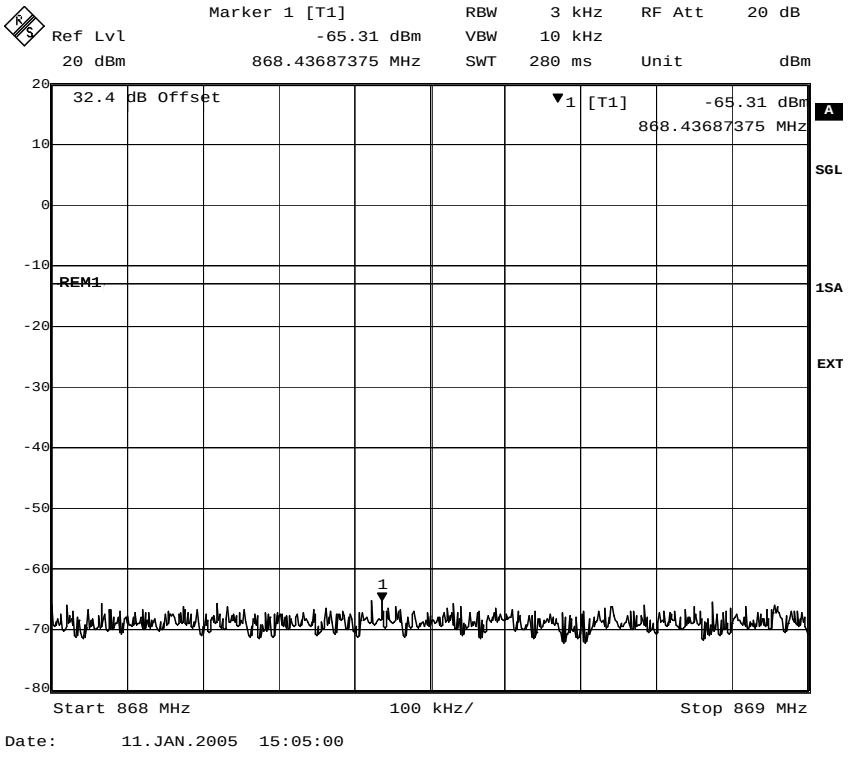

Fig. 37 – Spurious emissions in the frequency range 868 MHz – 869 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 881.6 MHz)

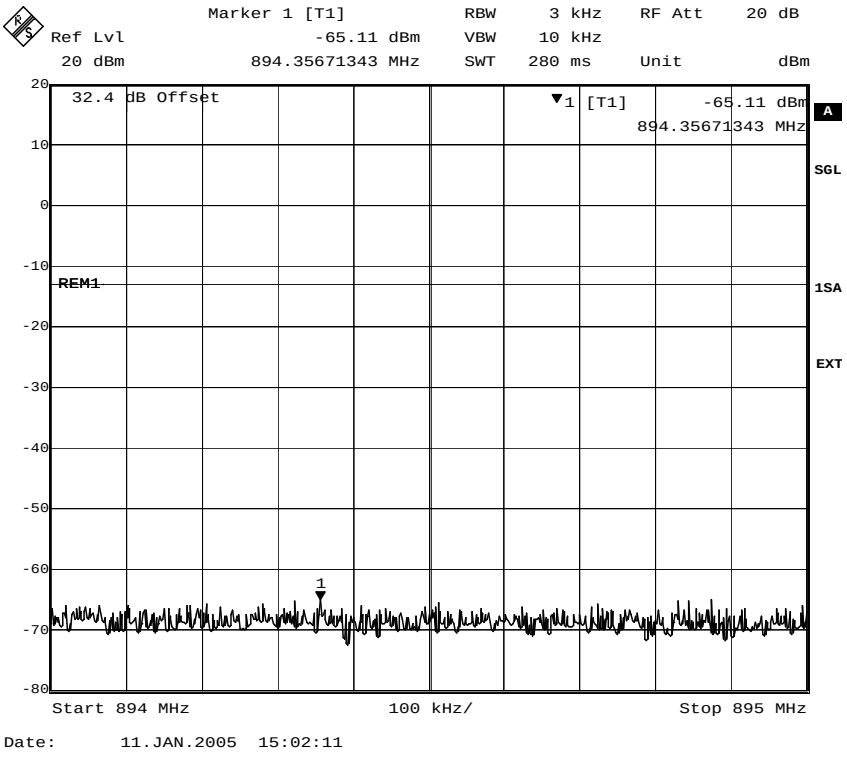

Fig. 38 – Spurious emissions in the frequency range 894 MHz – 895 MHz (GMSK modulation).

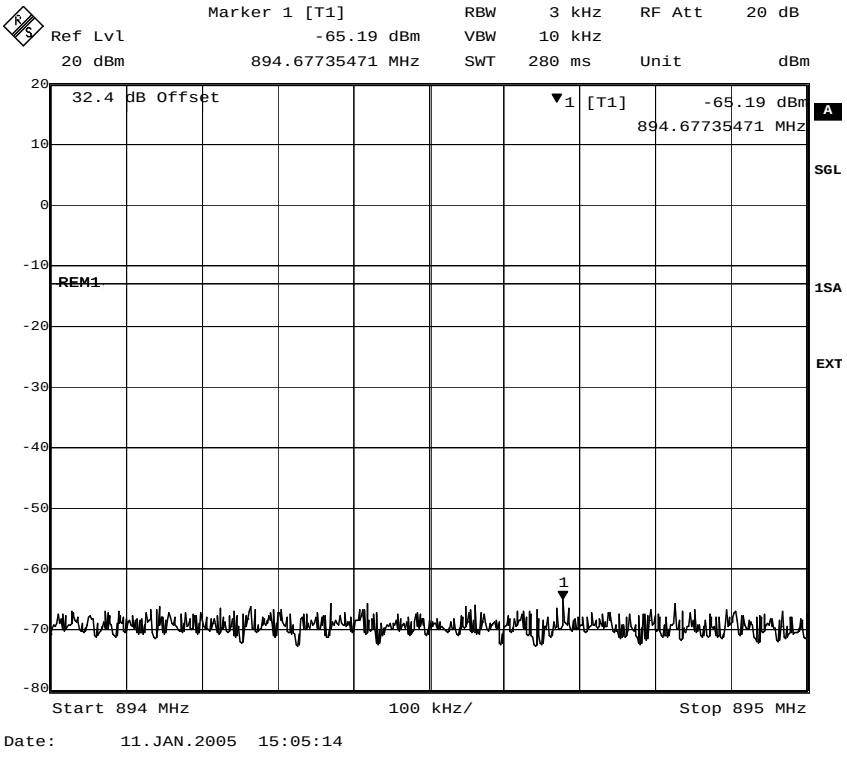

Fig. 39 – Spurious emissions in the frequency range 894 MHz – 895 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 881.6 MHz)

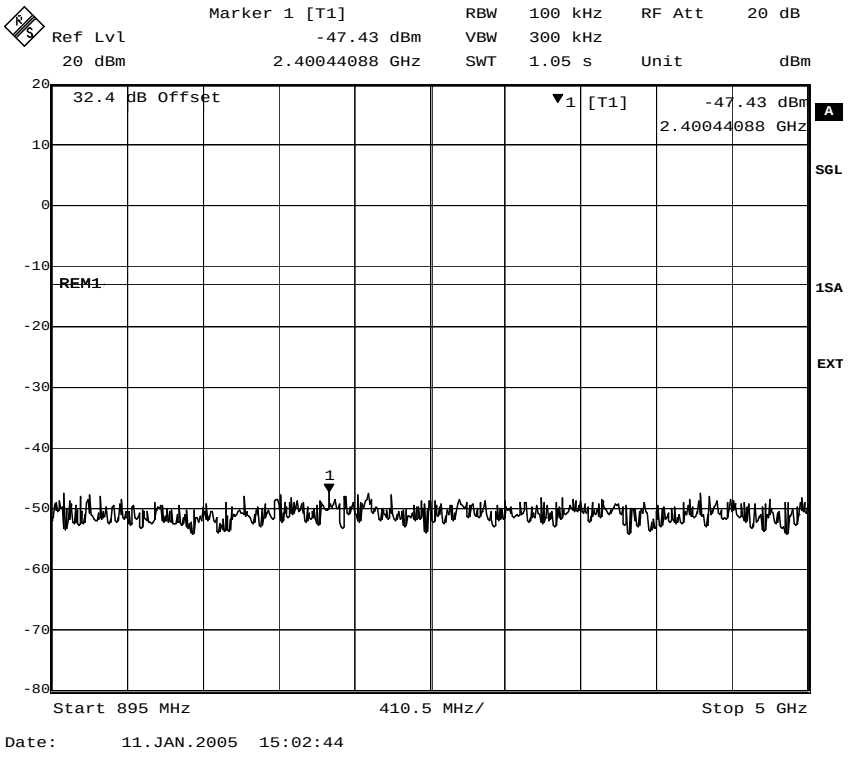

Fig. 40 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (GMSK modulation).

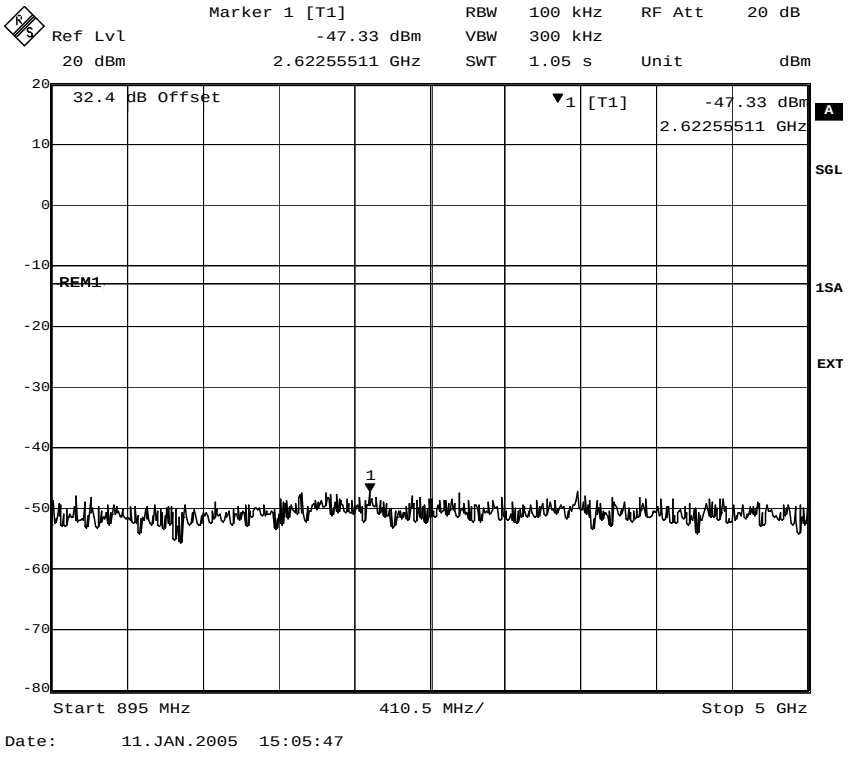

Fig. 41 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 881.6 MHz)

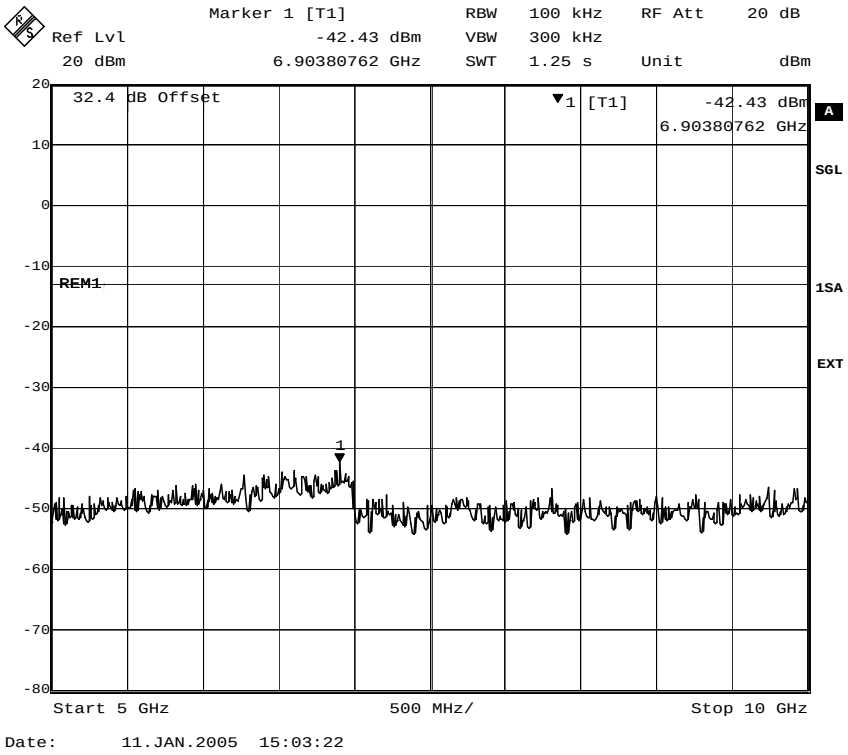

Fig. 42 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (GMSK modulation).

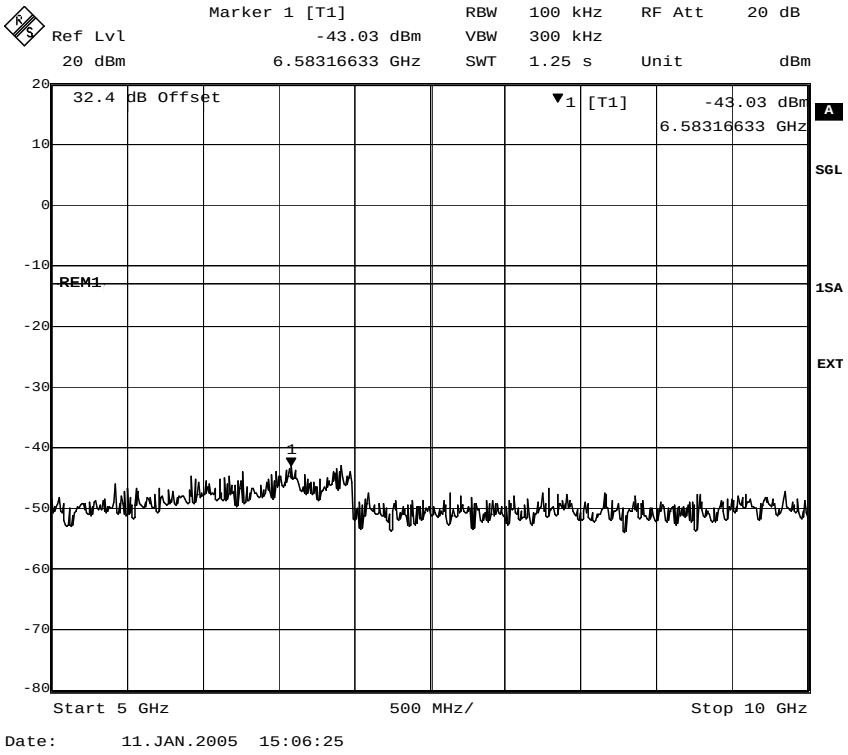

Fig. 43 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 893.8 MHz)

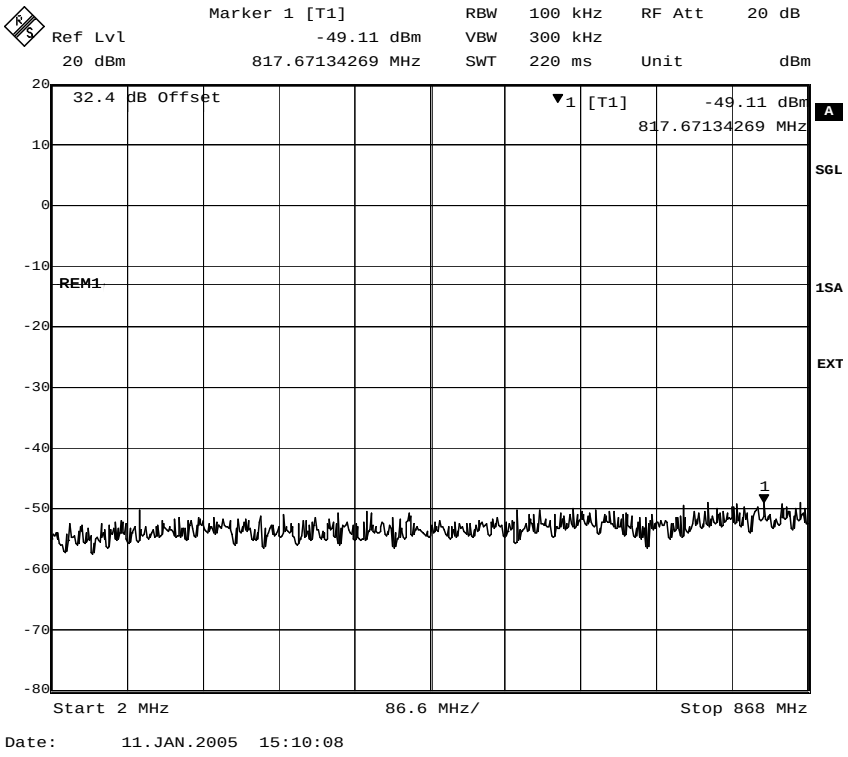

Fig. 44 – Spurious emissions in the frequency range 2 MHz – 868 MHz (GMSK modulation).

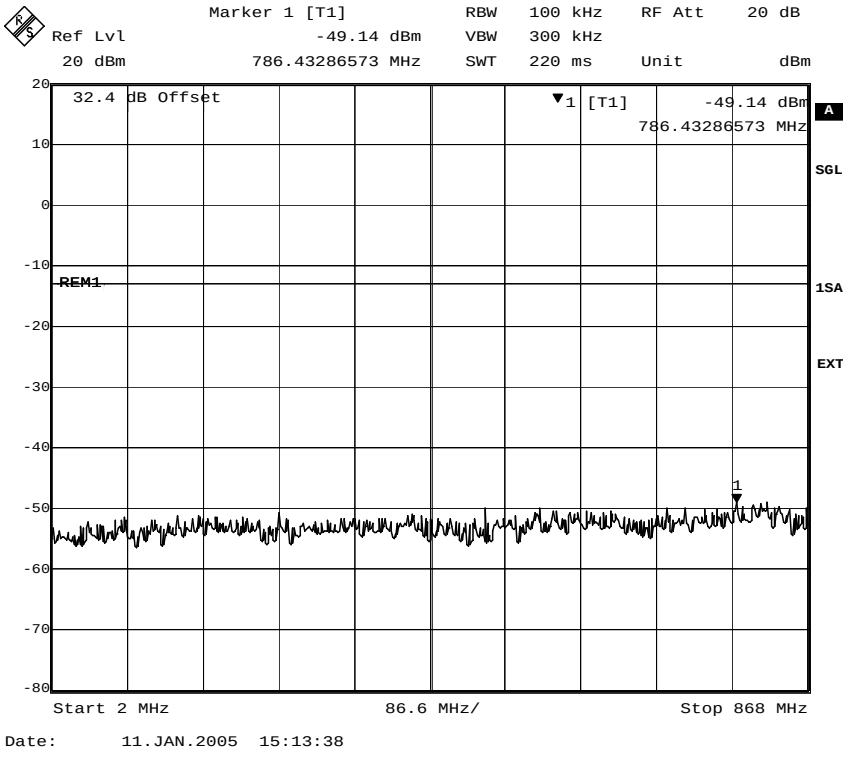

Fig. 45 – Spurious emissions in the frequency range 2 MHz – 868 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 893.8 MHz)

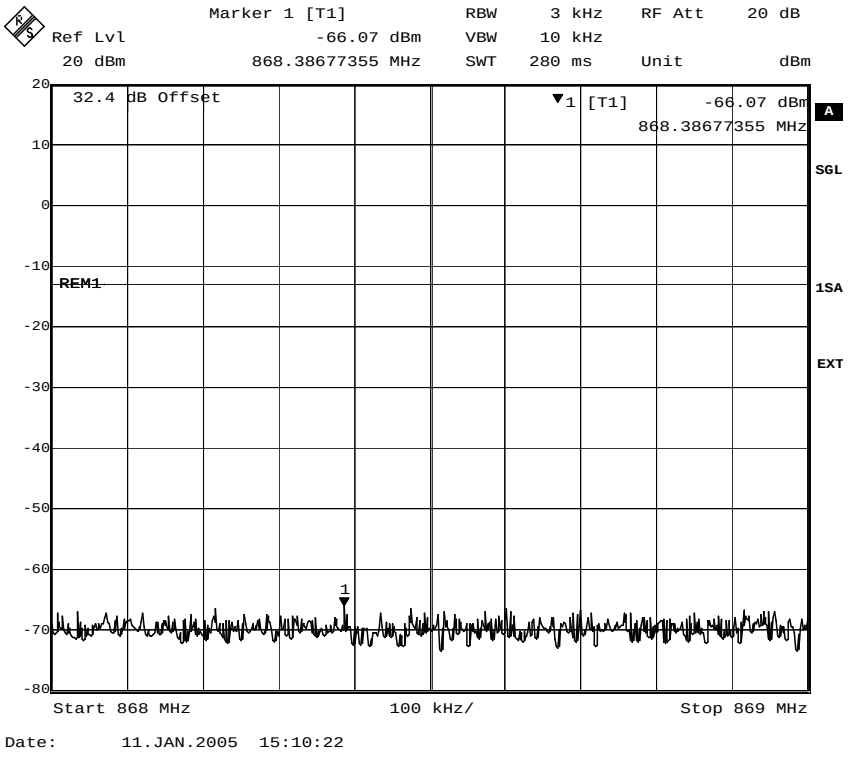

Fig. 46 – Spurious emissions in the frequency range 868 MHz – 869 MHz (GMSK modulation).

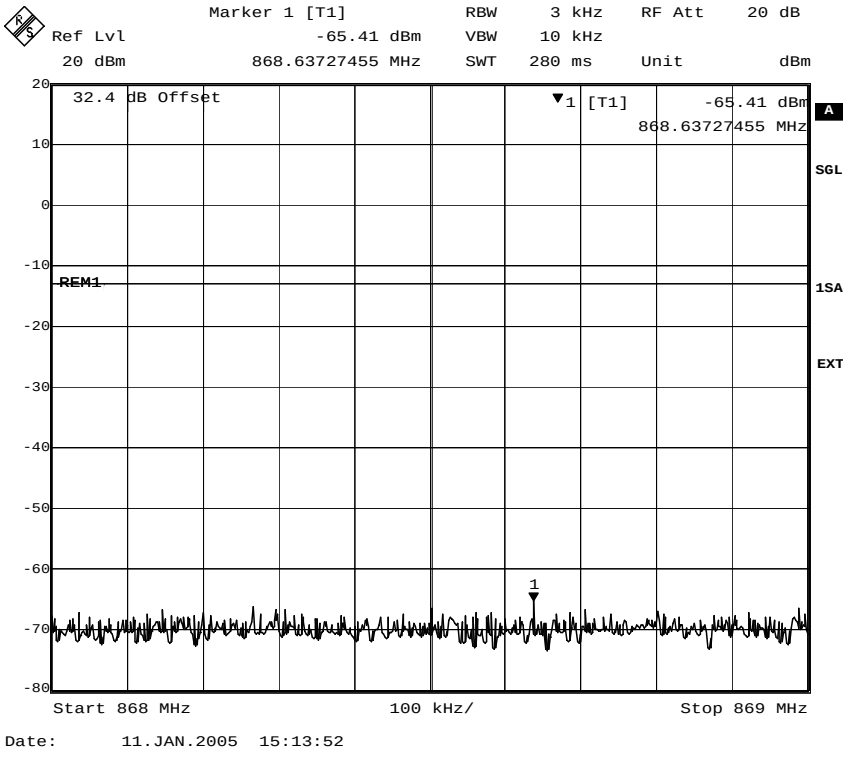

Fig. 47 – Spurious emissions in the frequency range 868 MHz – 869 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 893.8 MHz)

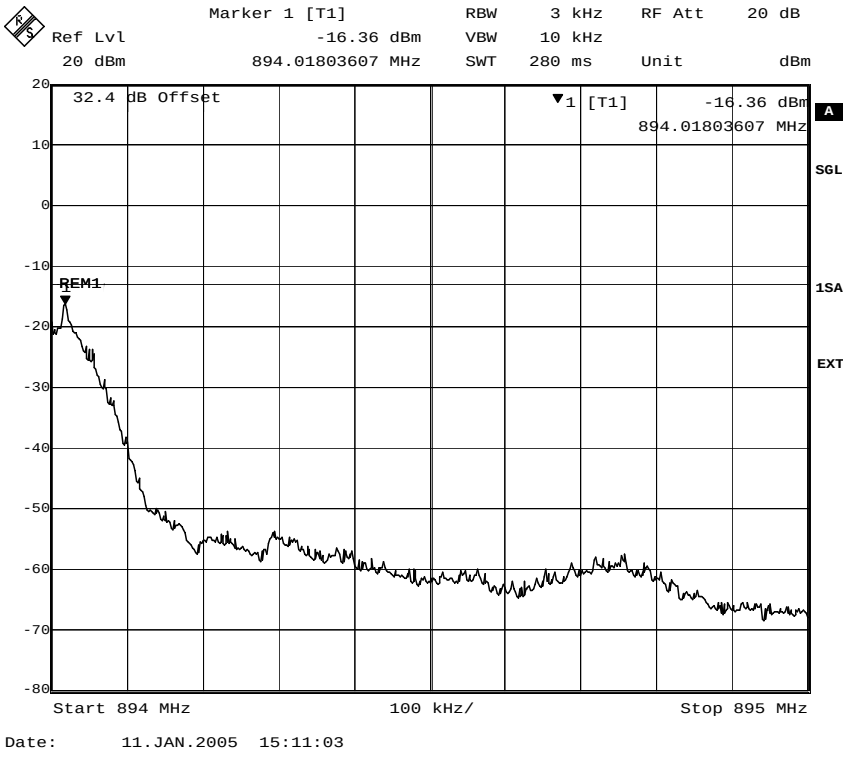

Fig. 48 – Spurious emissions in the frequency range 894 MHz – 895 MHz (GMSK modulation).

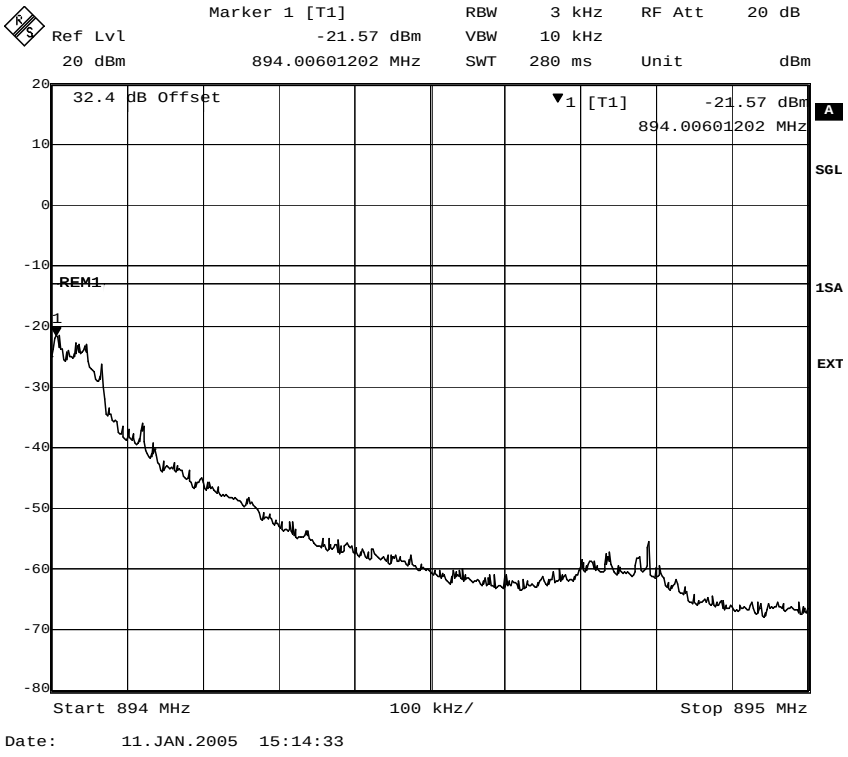

Fig. 49 – Spurious emissions in the frequency range 894 MHz – 895 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 893.8 MHz)

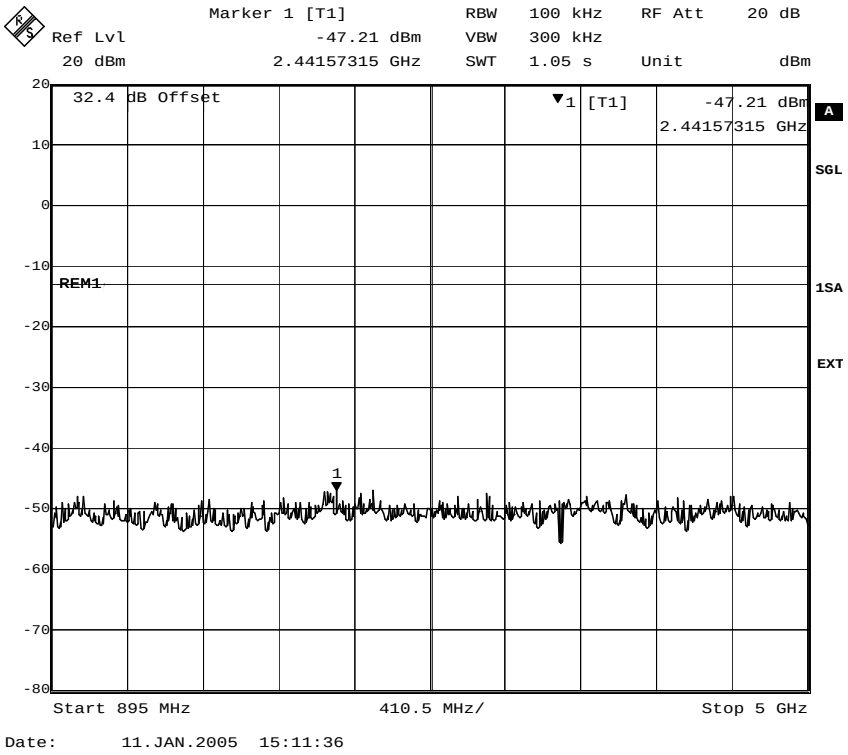

Fig. 50 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (GMSK modulation).

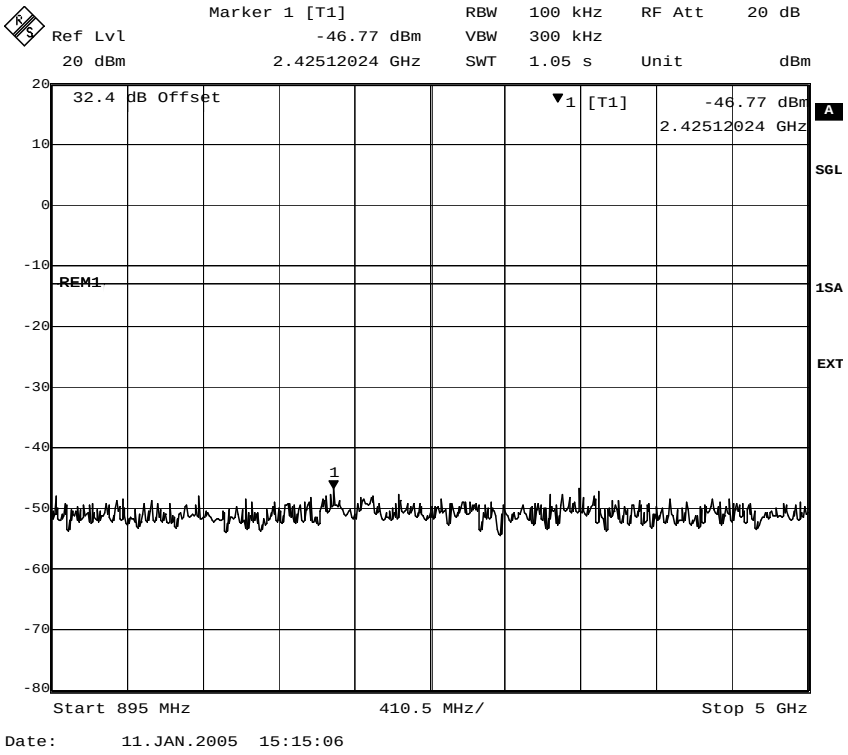

Fig. 51 – Spurious emissions in the frequency range 895 MHz – 5000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 4: Spurious Emissions at the Antenna Terminals (Carrier Test Frequency = 893.8 MHz)

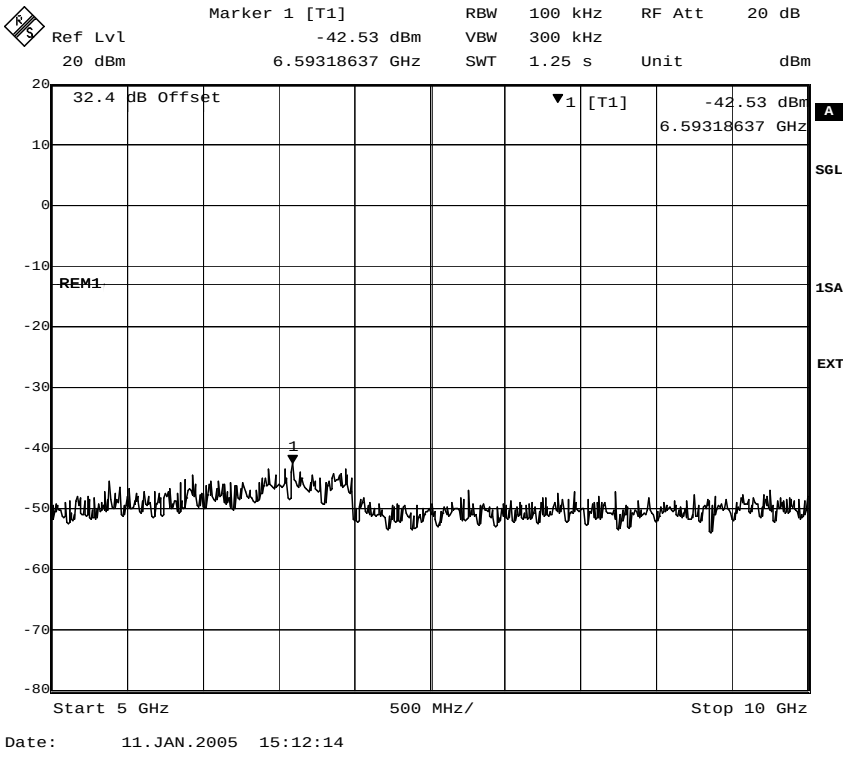

Fig. 52 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (GMSK modulation).

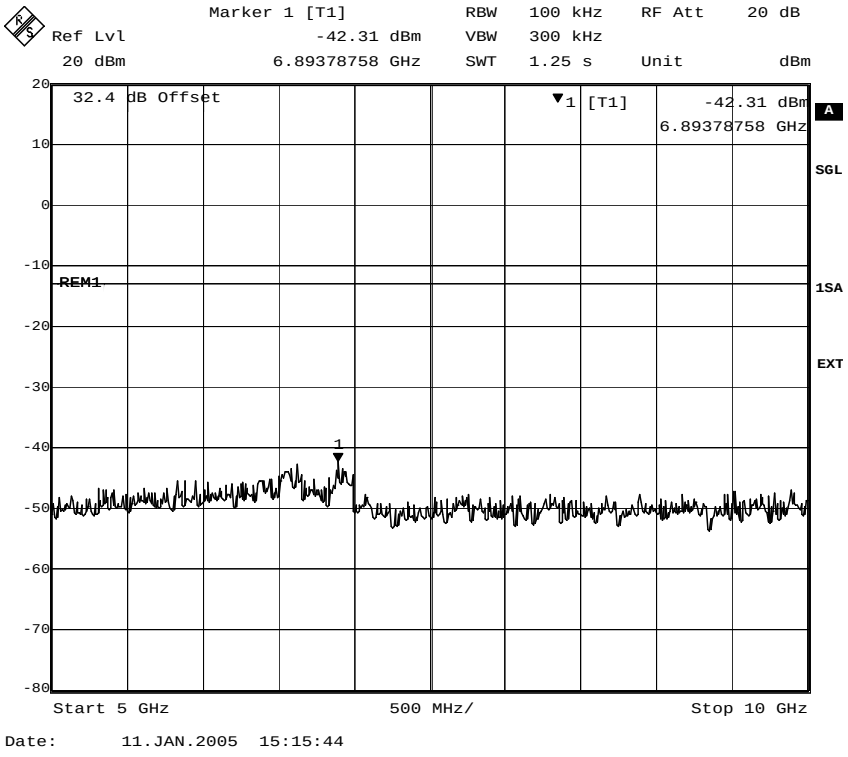

Fig. 53 – Spurious emissions in the frequency range 5000 MHz–10000 MHz (8PSK modulation).

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

3.2.5 Test No. 5: Field Strength of Spurious Radiation

Test No. 5: Field Strength of Spurious Radiation

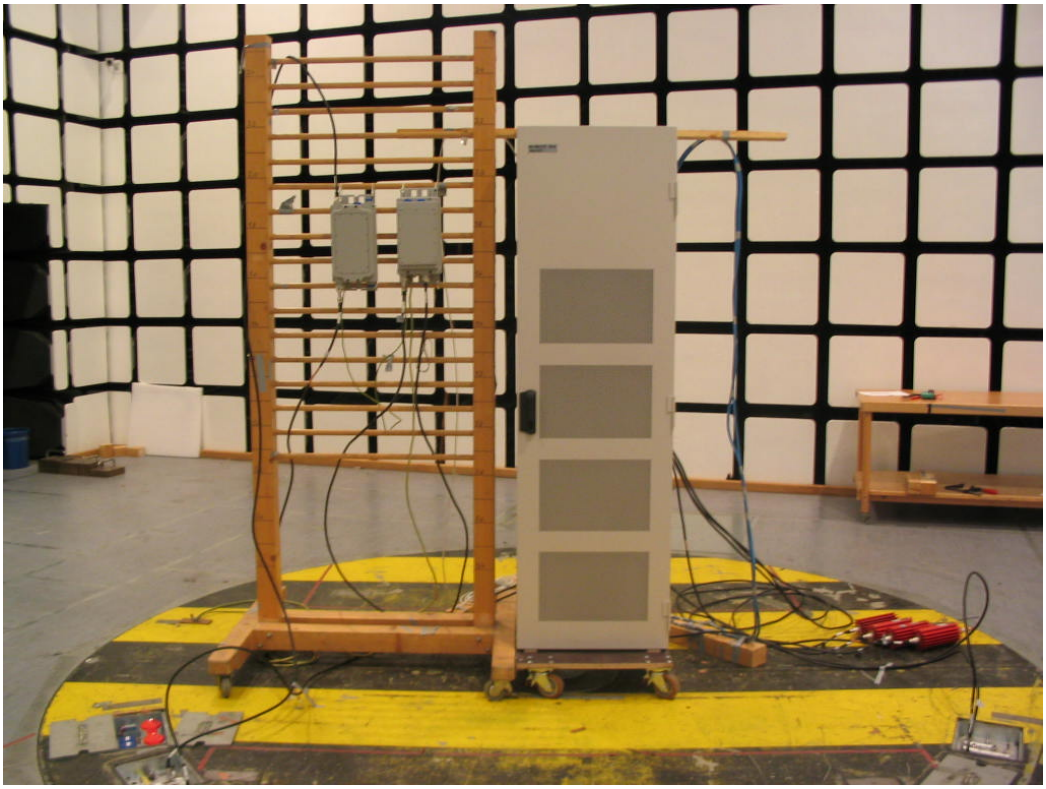

Fig. 54 – Photograph of the anechoic chamber with the EUT.

Fig. 55 – Photograph of the anechoic chamber with the test configuration for substitution method.

Test No. 5: Field strength of spurious radiation

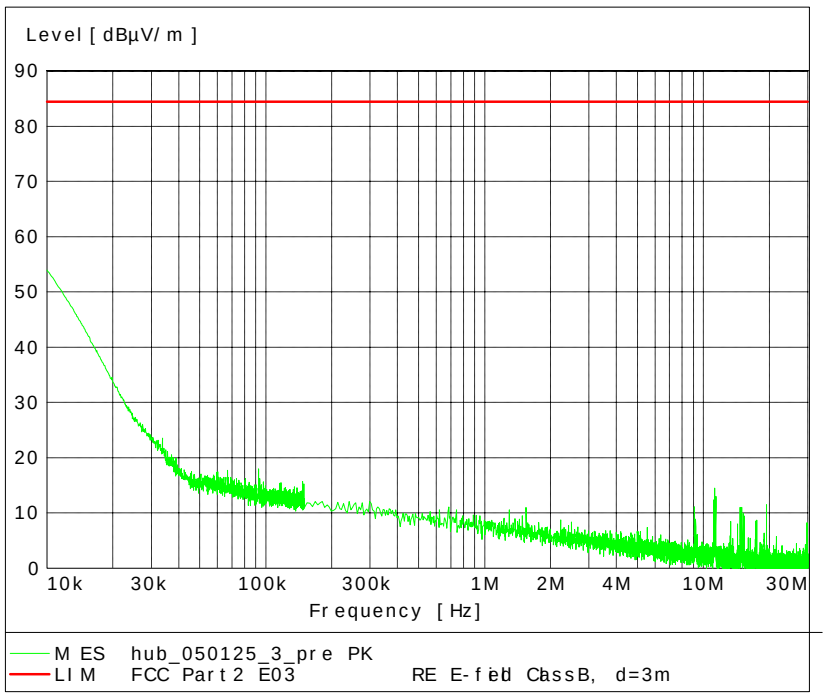

Fig. 56 – Radiated Emission 10 kHz – 30 MHz, GMSK modulation.

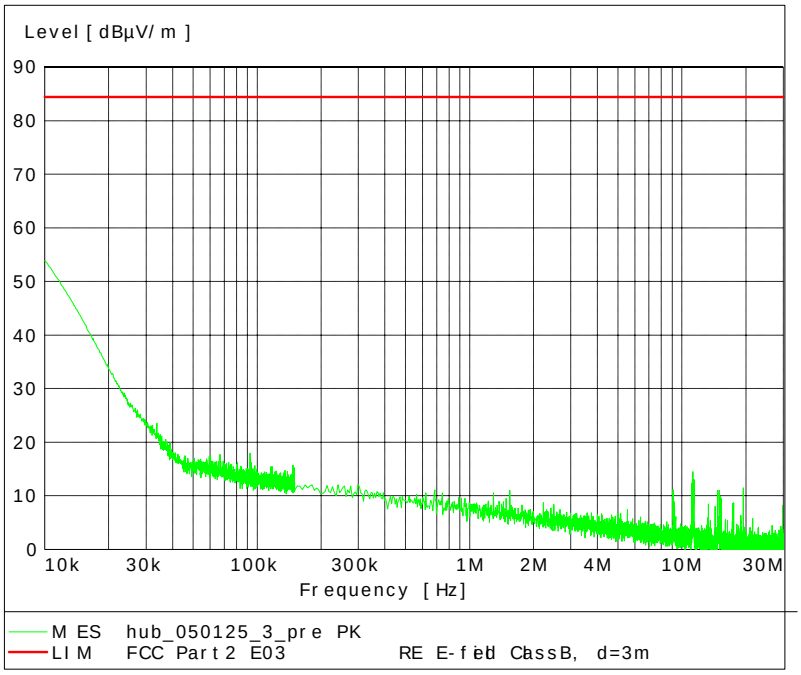

Fig. 57 – Radiated Emission 10 kHz – 30 MHz, 8PSK modulation.

Note: The frequencies shown on the plot were used for the spurious emission measurements using the "dipole substitution method".

Test No. 5: Field strength of spurious radiation

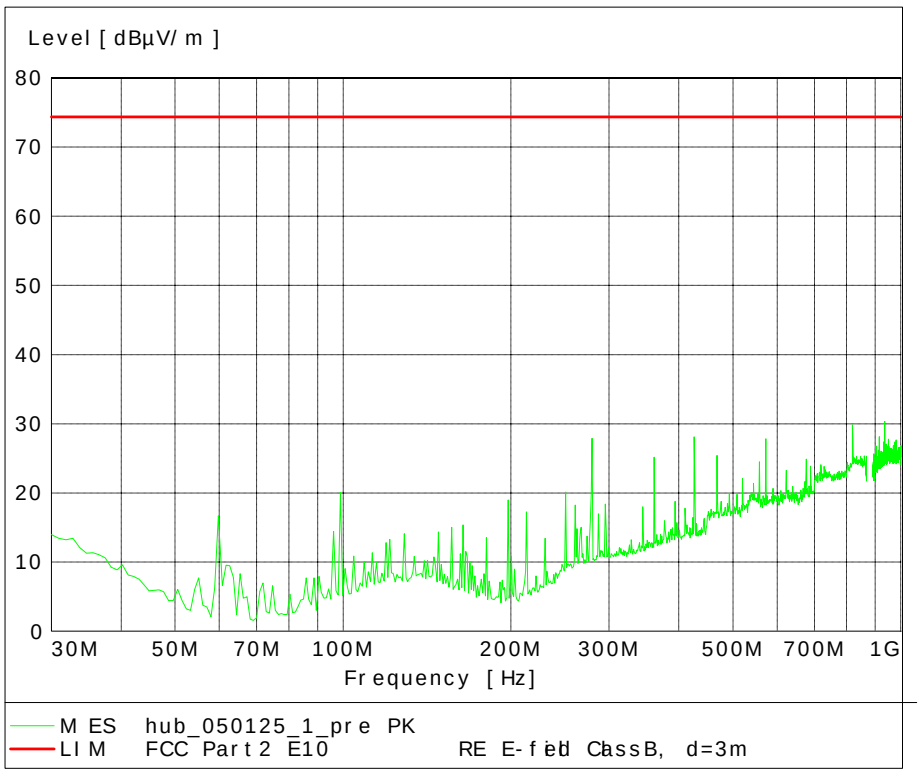

Fig. 58 – Radiated Emission 30 MHz – 1 GHz, GMSK modulation.

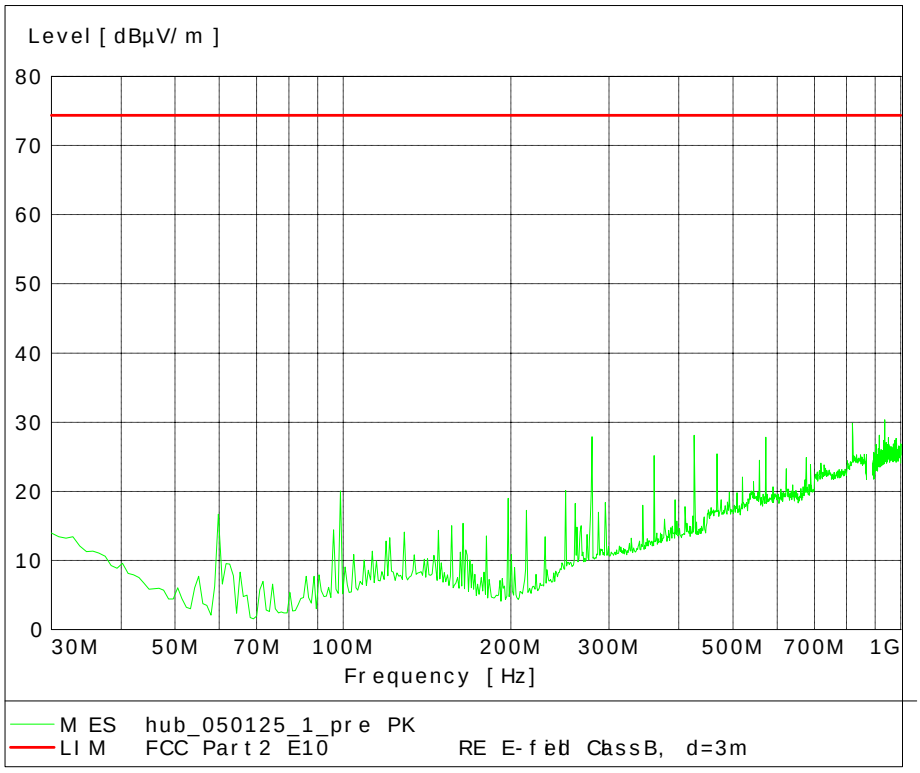

Fig. 59 – Radiated Emission 30 MHz – 1 GHz, 8PSK modulation.

Note: The frequencies shown on the plot were used for the spurious emission measurements using the "dipole substitution method".

Test No. 5: Field strength of spurious radiation

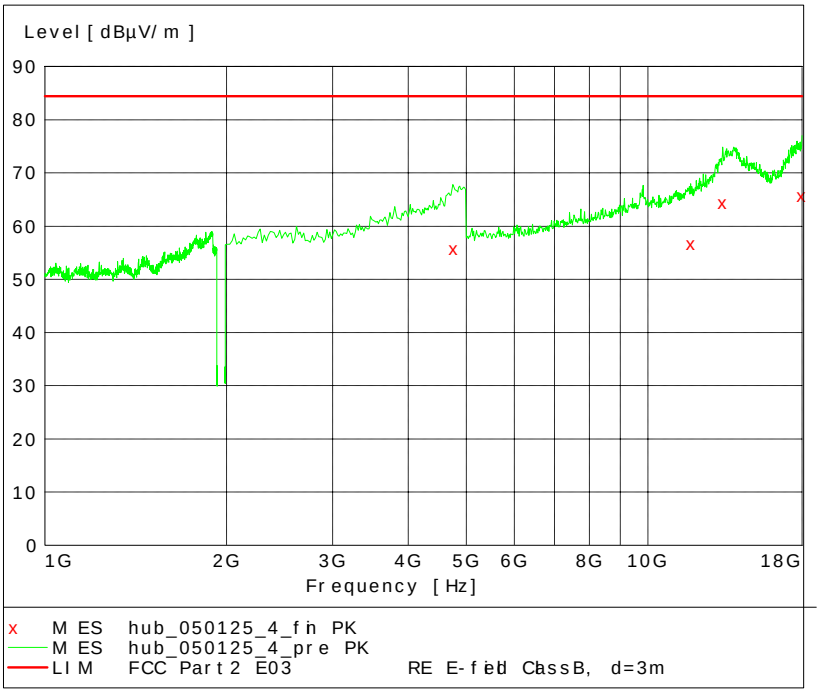

Fig. 60 – Radiated Emission 1 GHz – 18 GHz, GMSK modulation.

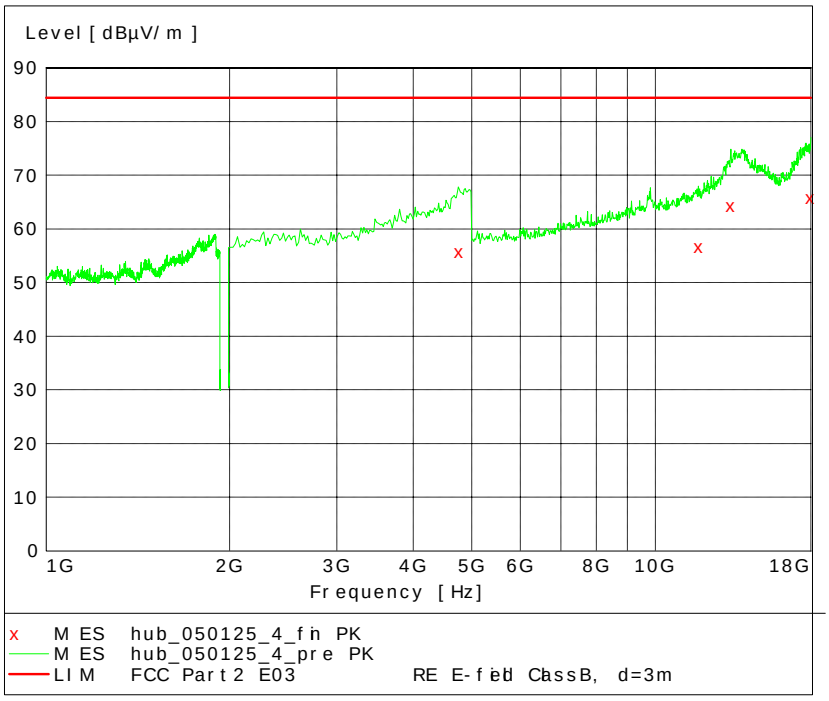

Fig. 61 – Radiated Emission 1 GHz – 18 GHz, 8PSK modulation.

Note: The frequencies shown on the plot were used for the spurious emission measurements using the "dipole substitution method".

Test No. 5: Field strength of spurious radiation

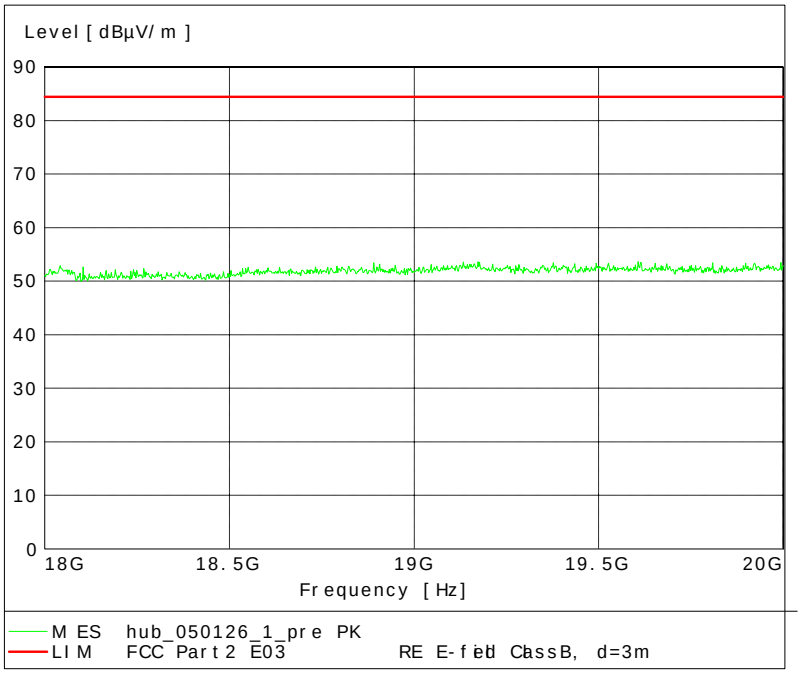

Fig. 62 – Radiated Emission 18 GHz – 20 GHz, GMSK modulation.

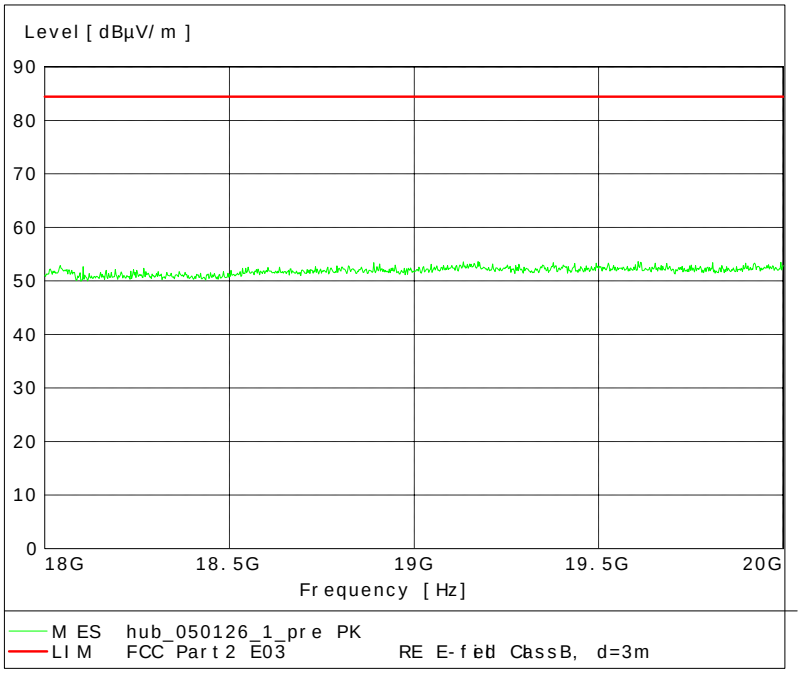

Fig. 63 – Radiated Emission 18 GHz – 20 GHz, 8PSK modulation.

Note: The frequencies shown on the plot were used for the spurious emission measurements using the "dipole substitution method".

3.2.6 Test No. 6: Frequency Stability

Test No. 6: Frequency Stability

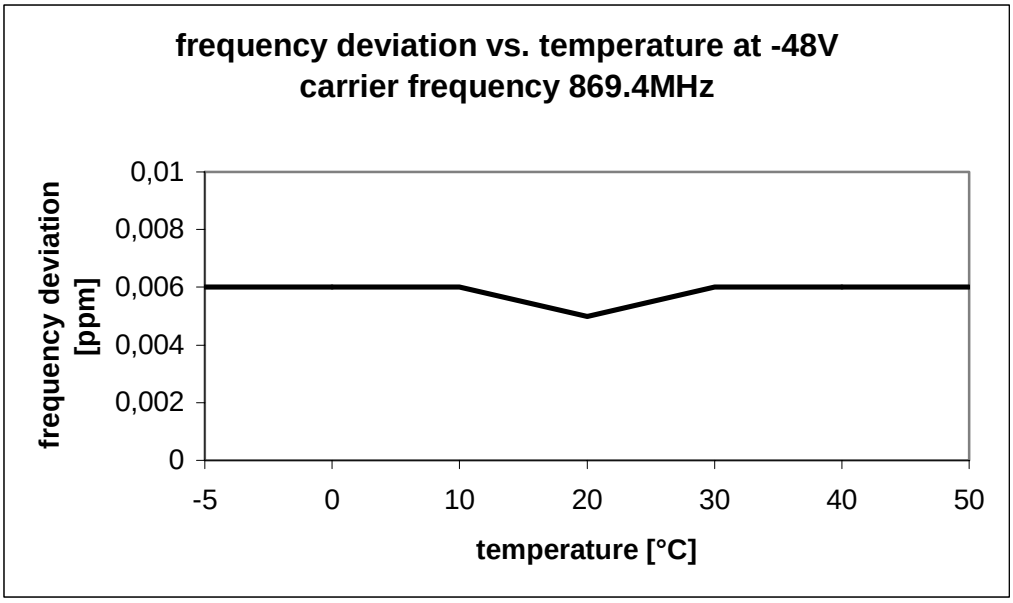

Fig. 64 – Frequency deviation vs. temperature (-48V, 869.4 MHz, GMSK modulation)

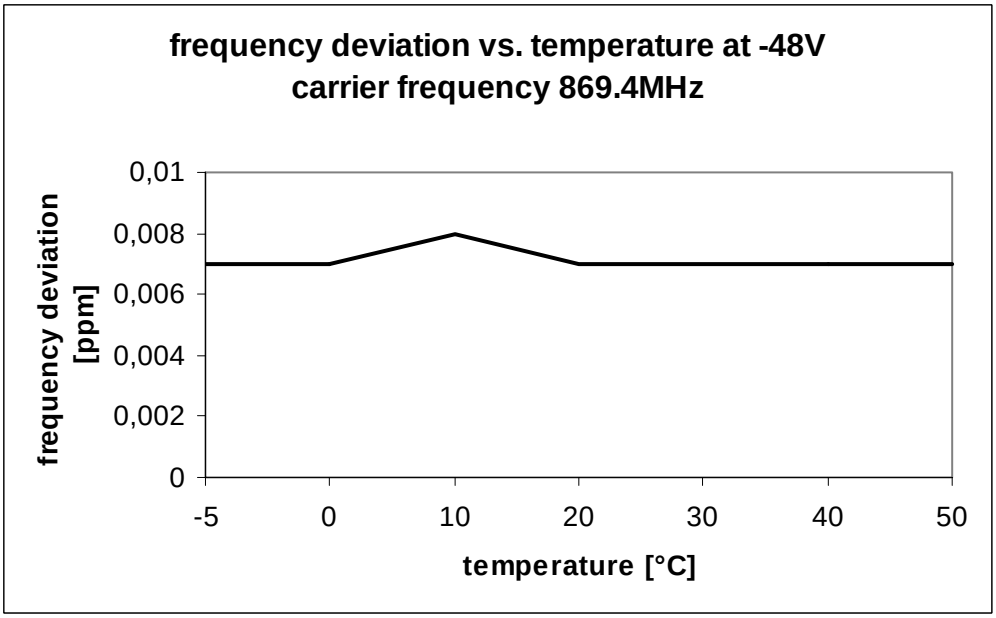

Fig. 65 – Frequency deviation vs. temperature (-48V, 869.4 MHz, 8PSK modulation)

Test No. 6: Frequency Stability

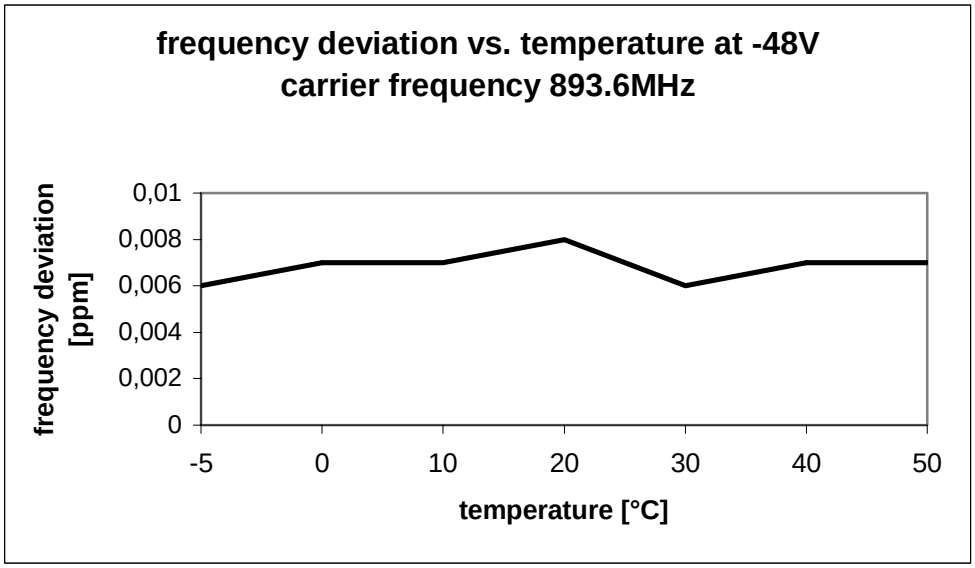

Fig. 66 – Frequency deviation vs. temperature (-48V, 893.6 MHz, GMSK modulation)

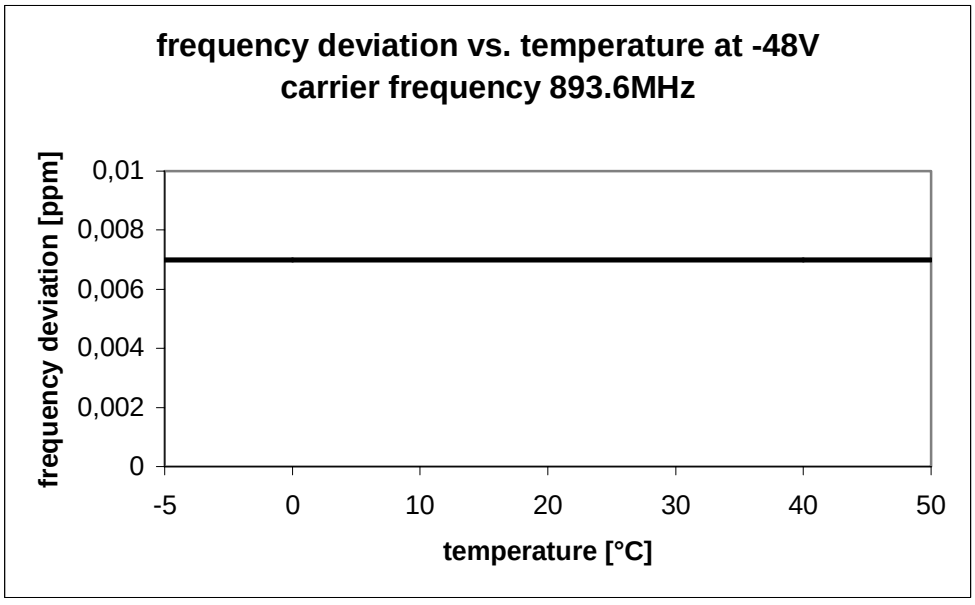

Fig. 67 – Frequency deviation vs. temperature (-48V, 893.6 MHz, 8PSK modulation)

3.2.7 Test No. 7: Slow Frequency Hopping

Test No. 7: Slow Frequency Hopping

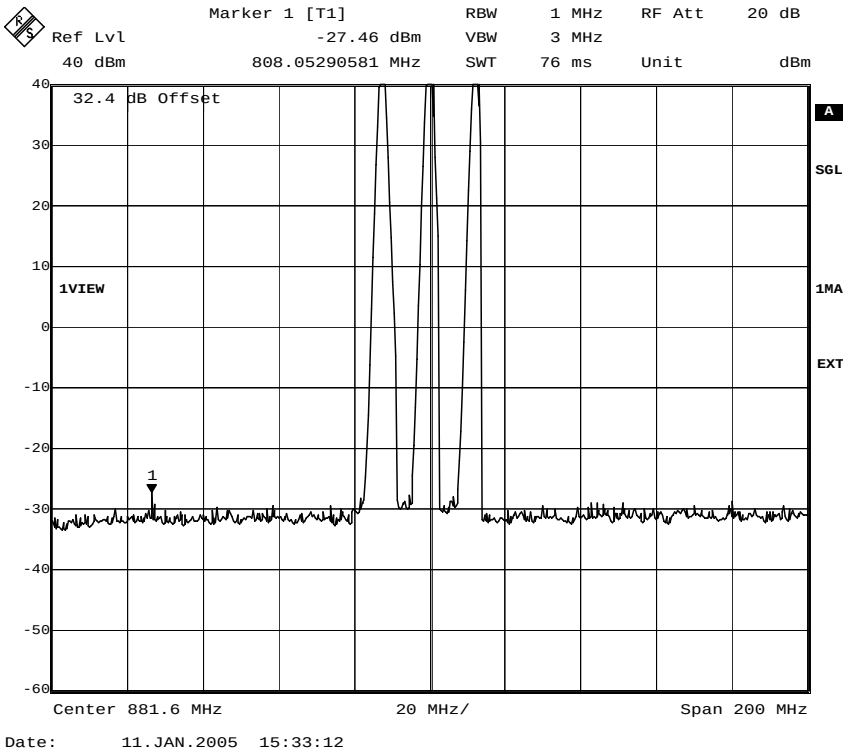

Fig. 68 – Slow frequency hopping – RBW = 1 MHz (GMSK modulation)

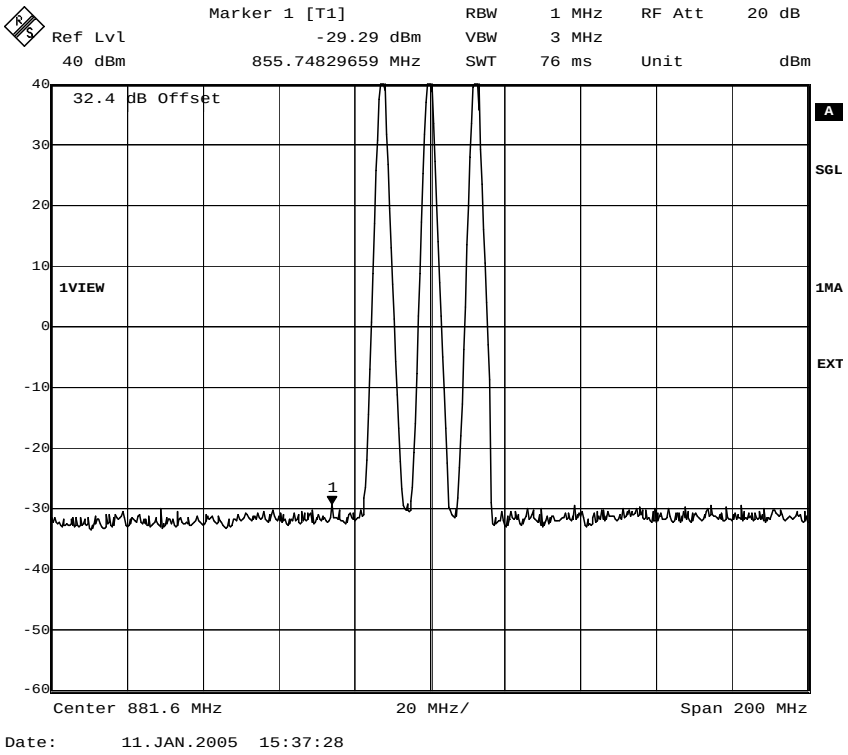

Fig. 69 – Slow frequency hopping – RBW = 1 MHz (8PSK modulation)

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 7: Slow Frequency Hopping

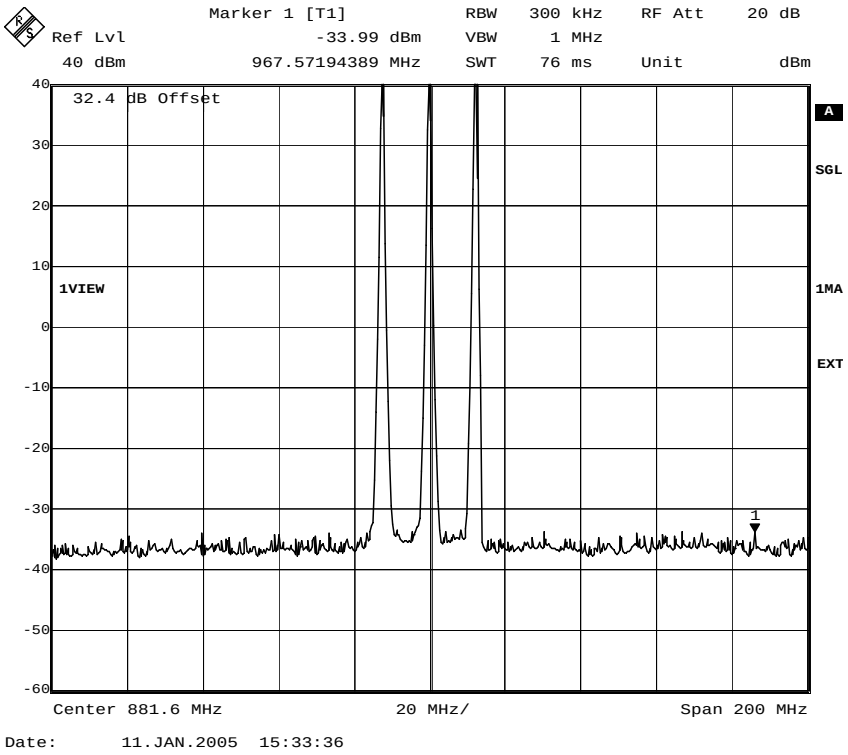

Fig. 70 – Slow frequency hopping – RBW = 300 kHz (GMSK modulation)

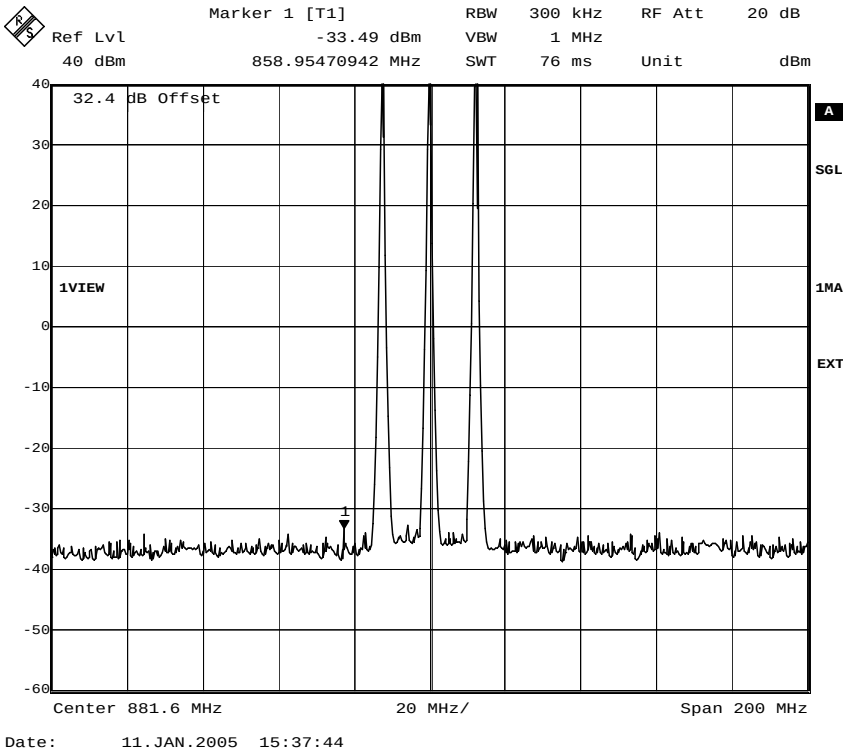

Fig. 71 – Slow frequency hopping – RBW = 300 kHz (8PSK modulation)

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.

Test No. 7: Slow Frequency Hopping

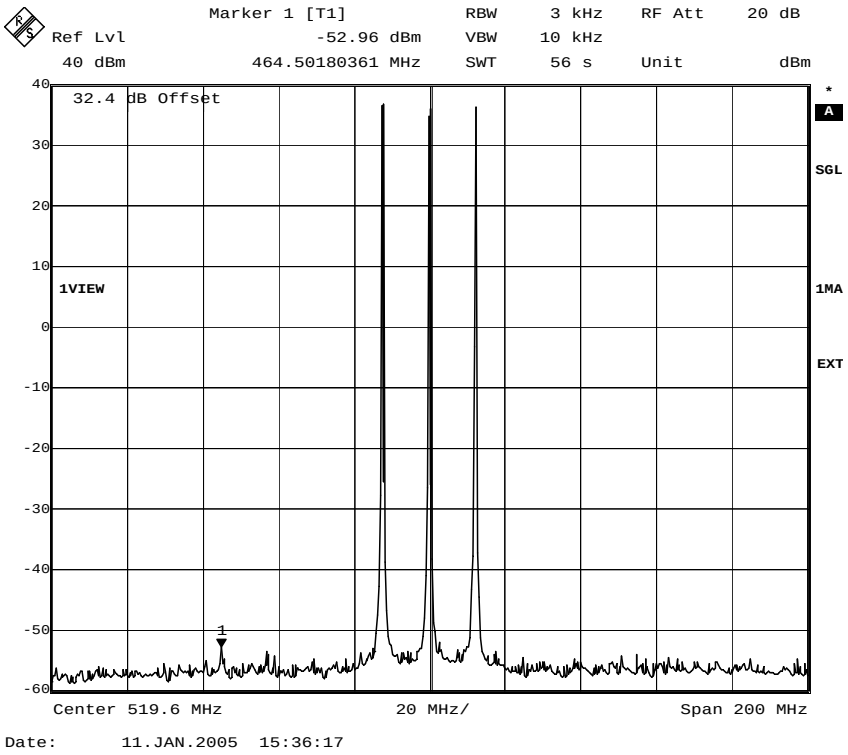

Fig. 72 – Slow frequency hopping – RBW = 3 kHz (GMSK modulation)

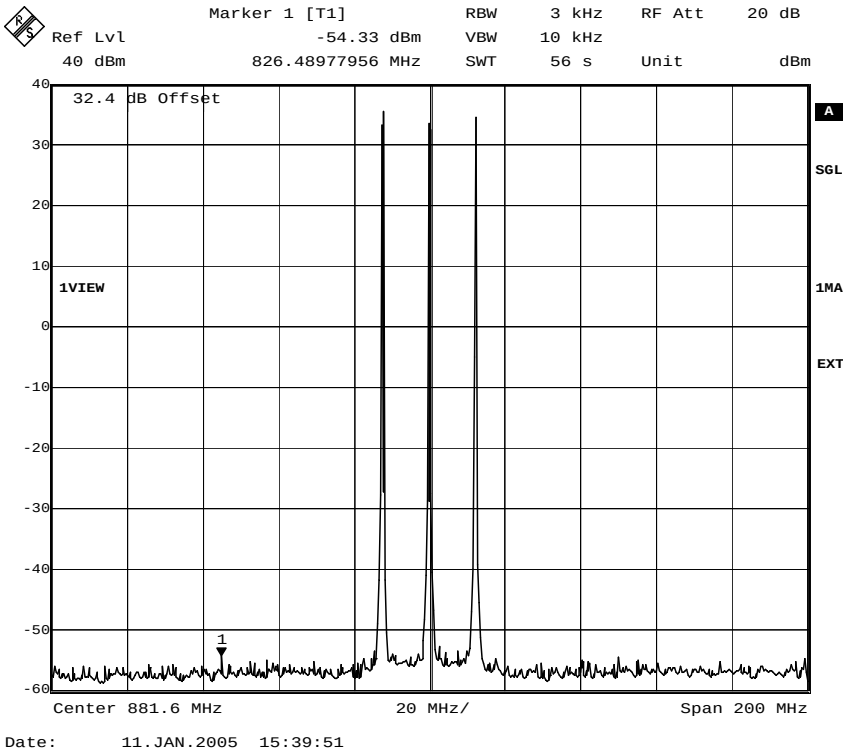

Fig. 73 – Slow frequency hopping – RBW = 3 kHz (8PSK modulation)

Note: The external attenuation of 32.4dB is included in the spectral plot. This accounts for the external attenuation and the cable loss during the testing.