



Center for Quality Engineering

Test Report No.: D0XD0013

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Client: Nokia Siemens Networks Oy

Equipment Under Test: Flexi Multiradio BTS RF module 1.7/2.1GHz
Radio Access Technology: E-UTRA

Manufacturer: Nokia Siemens Networks Oy

Task: Conformance test according to the test specifications mentioned below

Test Specification(s): FCC 47 CFR Part 2 and 27

Result: The EUT complies with the requirements of the specification.

The results relate only to the items tested as described in this test report.

approved by:

Date

Signature

Neuhäusler
Lab Manager Technical Services

Oct 15, 2010

Bauer
Lab Manager EMC

Oct 15, 2010

This document was signed electronically.

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1 Summary

The measurements described in this report were conducted pursuant to 47 CFR § 2.947 and § 2.1041. All applicable paragraphs of the 47 CFR parts 2 and 27 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	Result
1	RF Power Output	§ 2.1046, § 27.50	11	compliant
2	Modulation Characteristics	§ 2.1047, § 2.201	13	compliant
3	Occupied Bandwidth	§ 2.1049	14	compliant
4	Spurious Emissions at Antenna Terminals	§ 2.1051, § 2.1057, § 27.53	16	compliant
5	Field Strength of Spurious Radiation	§ 2.1053, § 27.53	20	compliant
6	Frequency Stability	§ 2.1055, § 27.54	22	compliant

Table 1-1: Results – Summary

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

2 References

2.1 Specifications

No	Standard	Title	Date
[1]	FCC 47 CFR Part 2 and 27	Code of Federal Regulations, Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations Part 27: Miscellaneous Wireless Communications Services ¹	2009-10

1) Updated by: Federal Register / Vol. 75, No. 141 / Friday, July 23, 2010 / Rules and Regulations / 43088

2.2 Glossary of Terms

QPSK	Quadrature Phase Shift Keying -Modulation
16QAM	16 Quadrature Amplitude Modulation
64QAM	64 Quadrature Amplitude Modulation
AC	Alternating Current
ANT	Antenna
BTS	Base Transceiver System
BW	Bandwidth
chk	checked against a calibrated reference
cnn	calibration not necessary
DC	Direct Current
EIRP	Equivalent Isotropic Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
LTE	Long Term Evolution
P	Power
Prat	Rated Output Power
RF	Radio Frequency

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3 General Information

3.1 Identification of Client

Nokia Siemens Networks Oy
P.O. Box 319,
Kaapelitie 4,
FI-90651, Oulu, Finland
Jari Virta

3.2 Test Laboratory

Nokia Siemens Networks Oy
P.O. Box 319,
Kaapelitie 4,
FI-90651, Oulu, Finland
Jari Virta

3.3 Time Schedule

Test No.:	1, 2, 3, 4, 6	5
Start of Test:	Aug 25, 2010	Aug 27, 2010
End of Test:	Oct 13, 2010	Aug 27, 2010

3.4 Participants

Name	Function
Rami Salomäki (NSN)	Testing, Setup of EUT
Hannu Eskola (NSN)	Testing, Setup of EUT
Sami Riuttanen (NSN)	Testing, Setup of EUT
Jarmo Koskela (NSN)	Testing, Setup of EUT
Stephane Nakpane (SGS CQE)	Editor

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4 Equipment Under Test

The tested equipment is representative for serial production.

4.1 Description of EUT

The BTS performs the full RAN function of LTE system (evolved UTRA). This is sometimes referred to as collapsed RAN, where equivalent functions of former 3G BTS and 3G RNC are all integrated into BTS. BTS is connected directly to the core network via S1 interface, and to mobile stations via Air interface (Uu). In addition BTSs are optionally connected directly to each others via X2 interface for handover purposes.

4.2 Configuration of EUT

The used different EUT configurations are shown by the following tables.

Module Type	Flexi Multiradio BTS RF module 1.7/2.1GHz	
Radio Access Technology	E-UTRA	
Frequency Bands	Uplink	Downlink
Block A:	1710 – 1720 MHz	2110 – 2120 MHz
Block B:	1720 – 1730 MHz	2120 – 2130 MHz
Block C:	1730 – 1735 MHz	2130 – 2135 MHz
Block D:	1735 – 1740 MHz	2135 – 2140 MHz
Block E:	1740 – 1745 MHz	2140 – 2145 MHz
Block F:	1745 – 1755 MHz	2145 – 2155 MHz
	Single Carrier	
Rated Output Power (Prat)	60 W	
Channel Bandwidth	20MHz (Config. A)	
	RX	TX
Number of Antenna Ports	6 (RX1 to RX6)	6 (TX1 to TX6)
MIMO	Yes	Yes

Table 4-1: Overview of EUT Configuration

The tests were performed with one EUT at the antenna ports TX1 and TX2.

The used different EUT configurations are shown by the following table.

Module Name	Serial-No.	Module Type	Config.
FRIE	L9103100256	RF module	A
FRIE	L9103100255	RF module	A
Other Modules	Module Type		Config.
FSME	System module		A
FTLB	Transmission module		A

Table 4-2: Configuration of EUT

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

4.3 Operating Conditions

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

The transmitter was set up according to 3GPP TS 36.141 E-UTRA Test Models (E-TM) for all tests.

- E-TM 1.1: QPSK modulation,
- E-TM 3.1: 64QAM modulation,
- E-TM 3.2: 16QAM modulation

The Flexi Multiradio BTS was supplied with 48 V DC.

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

During the tests, the Flexi Multiradio BTS is transmitting a pseudo random bit pattern on the data channels. This ensures that the measurements of the emission characteristics of the transmitter are pursuant to § 2.1049.

4.4 Compliance Criteria

The EUT must fulfil the requirements (described in the specifications mentioned in chapter 2.1, Specifications) for the selected test cases.

5 General Description of Tests

5.1 Tested Carrier Frequencies

The measurements were on 3 carrier frequencies, according to the following table:

Config A:

Channel Bandwidth: 20MHz	
Frequency [MHz]	Remark
2120.0	lowest possible carrier frequency
2132.5	frequency at the middle of the band
2145.0	highest possible carrier frequency

Table 5-1: Carrier Frequencies for 20MHz channel bandwidth

5.2 Modulation Characteristics

The EUT supports QPSK, 16QAM and 64QAM modulation.

5.3 Test Configuration

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

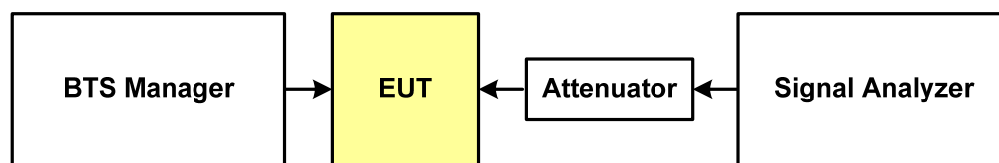


Figure 5-1: Test Configuration

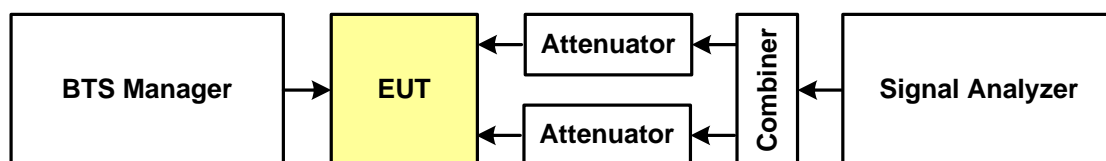


Figure 5-2: Test Configuration combined output

The RF output of the transceiver (cell) under test is connected to a signal analyzer via a high power attenuator to protect the input of the signal analyzer from high RF power levels. A description of the analyzer settings is given in each of the sections describing the measurements. The other transceivers are terminated.

A complete list of the measurement equipment is included on page 26 of this measurement report.

5.4 Calibration of the Test Equipment

All relevant test equipment has a valid calibration from an external calibration laboratory. Additionally the signal 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.

6 Test Results

6.1 Test No. 1: RF Power Output (§ 2.1046, § 27.50)

6.1.1 Purpose

The RF power output measurements were performed pursuant to § 2.1046 in order to determine the base station maximum RF output power of the EUT.

6.1.2 Limits

According to § 27.50, base stations are limited to an EIRP of 1640 watts/MHz peak EIRP (when transmitting with an emission bandwidth greater than 1 MHz).

6.1.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.1.4 Test Configuration

The test configuration used is described in section 5.3 of this report.

6.1.5 Test Procedure and Results

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter or a signal analyzer.

Using a signal analyzer the RF power is measured with a frequency sweep across the carrier (see screenshots). The carrier power is calculated from the signal analyzer by integration over the result. 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 antenna connector. Screenshots of the measurements are included on pages 27 of this report.

Config A:

Carrier Frequency	Base Station Maximum Output Power		Result
[MHz]	[dBm]	[W]	
QPSK-Modulation TX1			
2120.0	47.27	53.33	compliant
2132.5	47.64	58.08	compliant
2145.0	47.69	58.75	compliant
QPSK-Modulation TX2			
2120.0	47.39	54.83	compliant
2132.5	47.31	53.83	compliant
2145.0	47.52	56.49	compliant
QPSK-Modulation TX1+TX2			
2120.0	50.34	108.16	compliant
2132.5	50.49	111.91	compliant
2145.0	50.62	115.24	compliant
16QAM-ModulationTX1			
2120.0	47.46	55.72	compliant
2132.5	47.52	56.49	compliant
2145.0	47.78	59.98	compliant
16QAM-Modulation TX2			
2120.0	47.40	54.95	compliant
2132.5	47.38	54.70	compliant
2145.0	47.63	57.94	compliant
16QAM-Modulation TX1+TX2			
2120.0	50.44	110.67	compliant
2132.5	50.46	111.19	compliant
2145.0	50.72	117.92	compliant
64QAM-ModulationTX1			
2120.0	47.53	56.62	compliant
2132.5	47.67	58.48	compliant
2145.0	47.79	60.12	compliant
64QAM-Modulation TX2			
2120.0	47.21	52.60	compliant
2132.5	47.40	54.95	compliant
2145.0	47.61	57.68	compliant
64QAM-Modulation TX1+TX2			
2120.0	50.38	109.22	compliant
2132.5	50.55	113.43	compliant
2145.0	50.71	117.80	compliant
Measurement Uncertainty:		±0.4dB	

Table 6-1: Results – Base Station Maximum Output Power (20 MHz Channel BW)

The base station maximum output power was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

6.2 Test No. 2: Modulation Characteristics (§ 2.1047, § 2.201)

The occupied bandwidth was measured to be 20 MHz (Config. A), which represents the 99% power bandwidth (see the following section and screenshots on pages 31). Therefore, the modulation characteristic of the base stations transceiver is 20M0F9W.

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.

6.3 Test No. 3: Occupied Bandwidth (§ 2.1049)

6.3.1 Purpose

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

6.3.2 Limits

According to § 2.1049 the 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power.

6.3.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.3.4 Test Configuration

The test configuration used is described in section 5.3 of this report.

6.3.5 Test Procedure and Results

The 99% occupied bandwidth of the carrier emission is measured using a signal analyzer with Resolution Bandwidth set to 30kHz (less than 1% of bandwidth). (see screenshots on pages 31 for details). The following table summarizes the results:

Config A:

Carrier Frequency	Occupied Bandwidth	Result
[MHz]	[MHz]	
QPSK-Modulation TX1		
2120.0	17.8397	compliant
2132.5	17.8397	compliant
2145.0	17.8397	compliant
QPSK-Modulation TX2		
2120.0	17.8397	compliant
2132.5	17.8397	compliant
2145.0	17.8397	compliant
16QAM-Modulation TX1		
2120.0	17.8045	compliant
2132.5	17.8045	compliant
2145.0	17.8045	compliant
16QAM-Modulation TX2		
2120.0	17.8045	compliant
2132.5	17.8045	compliant
2145.0	17.8045	compliant

Carrier Frequency	Occupied Bandwidth	Result
[MHz]	[MHz]	
64QAM-Modulation TX1		
2120.0	17.8397	compliant
2132.5	17.8397	compliant
2145.0	17.8397	compliant
64QAM-Modulation TX2		
2120.0	17.8397	compliant
2132.5	17.8397	compliant
2145.0	17.8397	compliant
Measurement Uncertainty:		±96 kHz

Table 6-2: Results – Occupied Bandwidth (20 MHz Channel BW)

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

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6.4 Test No. 4: Spurious Emissions at Antenna Terminals (§ 2.1051, § 2.1057, § 27.53)

6.4.1 Purpose

The measurements of the spurious emissions at the equipment output terminals were performed pursuant to § 2.1051 in order to verify that all emissions are below the limits given by § 27.53.

6.4.2 Limits

Compliance with § 27.53 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 in the following way:

Maximum transmitter output power [W]:	P
Maximum transmitter output power [dBm]:	$30 + 10 \log_{10} P$ (conversion from W to dBm)
Attenuation required by FCC:	$43 + 10 \log_{10} P$

$$\begin{aligned} \text{Compliance limit} &= \text{Maximum transmitter output power} - \text{Required attenuation} \\ &= 30 + 10 \log_{10} P - (43 + 10 \log_{10} P) = \underline{-13 \text{ dBm}} \end{aligned}$$

6.4.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.4.4 Test Configuration

The test configuration used is described in section 5.3 of this report.

6.4.5 Test Procedure and Results

Signal analyzer settings:

The tests were carried out in accordance with § 27.53. For all frequency ranges except two (the one immediately below and the one immediately above the carrier frequency block) a 1 MHz resolution bandwidth was used for the measurements.

In the 1 MHz frequency bands immediately outside and adjacent to the carrier frequency block a resolution bandwidth is lowered to 1% of the 26 dB occupied bandwidth of the transmitted carrier and at minimum to 30kHz.

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 tables summarize the worst case detected emission levels (see screenshots on pages 35 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.

Config A Lower band edge:

Carrier Frequency: 2120 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation TX1			
	2110.0	-30.56	compliant
QPSK-Modulation TX2			
	2110.0	-30.93	compliant
QPSK-Modulation TX1+TX2			
	2110.0	-24.30	compliant
16QAM-Modulation TX1			
	2110.0	-30.57	compliant
16QAM-Modulation TX2			
	2110.0	-30.32	compliant
16QAM-Modulation TX1+TX2			
	2110.0	-23.98	compliant
64QAM-Modulation TX1			
	2110.0	-30.10	compliant
64QAM-Modulation TX2			
	2110.0	-31.26	compliant
64QAM-Modulation TX1+TX2			
	2110.0	-24.54	compliant
Measurement Uncertainty:			f < 1.0GHz: ±1.1dB 1.0GHz ≤ f < 3.6GHz: ±1.2dB 3.6GHz ≤ f < 8.0GHz: ±1.6dB 8.0GHz ≤ f: ±1.9dB

Table 6-3: Results - Spurious Emissions – Lower band edge (20 MHz Channel BW)

Config A Upper band edge:

Carrier Frequency: 2145 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation TX1			
	2155.0	-31.83	compliant
QPSK-Modulation TX2			
	2155.0	-31.33	compliant
QPSK-Modulation TX1+TX2			
	2155.0	-24.84	compliant
16QAM-Modulation TX1			
	2155.0	-30.07	compliant
16QAM-Modulation TX2			
	2155.0	-30.54	compliant
16QAM-Modulation TX1+TX2			
	2155.0	-24.40	compliant
64QAM-Modulation TX1			
	2155.0	-31.15	compliant
64QAM-Modulation TX2			
	2155.0	-31.23	compliant
64QAM-Modulation TX1+TX2			
	2155.0	-24.03	compliant
Measurement Uncertainty:			f < 1.0GHz: ±1.1dB 1.0GHz ≤ f < 3.6GHz: ±1.2dB 3.6GHz ≤ f < 8.0GHz: ±1.6dB 8.0GHz ≤ f: ±1.9dB

Table 6-4: Results - Spurious Emissions – Upper band edge (20 MHz Channel BW)

Config A:

Carrier Frequency: 2132.5 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation TX1			
0.009 - 22000	2976.202	-30.60	compliant
QPSK-Modulation TX2			
0.009 - 22000	3000.000	-33.20	compliant
QPSK-Modulation TX1+TX2			
0.009 - 22000	2980.962	-30.08	compliant
16QAM-Modulation TX1			
0.009 - 22000	2995.240	-33.17	compliant
16QAM-Modulation TX2			
0.009 - 22000	2990.481	-33.17	compliant
16QAM-Modulation TX1+TX2			
0.009 - 22000	2985.721	-30.10	compliant
64QAM-Modulation TX1			
0.009 - 22000	3000.000	-33.16	compliant
64QAM-Modulation TX2			
0.009 - 22000	2990.481	-33.18	compliant
64QAM-Modulation TX1+TX2			
0.009 - 22000	2980.962	-30.09	compliant
Measurement Uncertainty:			f < 1.0GHz: ±1.1dB 1.0GHz ≤ f < 3.6GHz: ±1.2dB 3.6GHz ≤ f < 8.0GHz: ±1.6dB 8.0GHz ≤ f: ±1.9dB

Table 6-5: Results - Spurious Emissions (20 MHz Channel BW)

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

6.5 Test No. 5: Field Strength of Spurious Radiation (§ 2.1053, § 2.1057, § 27.53)

6.5.1 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 $43 + 10 \log_{10} (P \text{ in Watts})$ dB as is required by § 27.53 (Emission limits).

6.5.2 Limits

Compliance with § 27.53 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:

Rated maximum transmitter output power:	60.0 W (= 47.78 dBm)
Required attenuation:	$43 + 10 \log_{10} 60.0 = \mathbf{60.78 \text{ dB}}$

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

6.5.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.5.4 Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements listed in ANSI C63.4 2003 and is listed with the FCC.

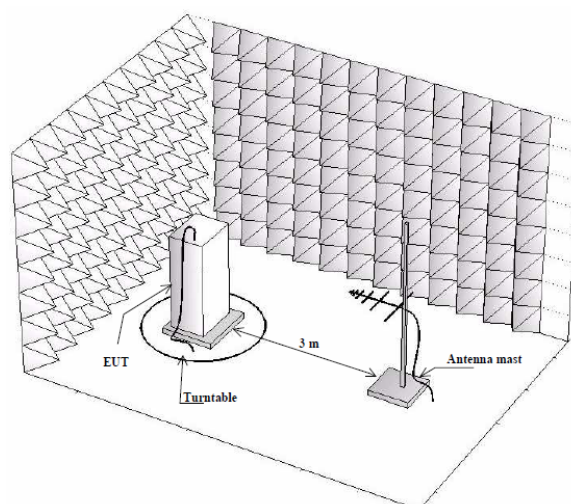


Figure 6-1: Test Configuration

Photographs of the EUT in the anechoic chamber are shown on page 63 of this measurement report.

6.5.5 Test Procedure

TIA/EIA-603-C-2004, Section 2.2.12

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable. During the test in the frequency range 30 – 22000 MHz the distance from the EUT to the measuring antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations.

Vertical and horizontal polarizations in the frequency range 30 – 22000 MHz was first measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 2.5 m.

The limit of -13 dBm has been calculated to correspond 84.4 dB (μV/m).
Spurious emissions closer than 20 dB to the limit was measured with average detector.

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The EUT was replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator $G_{Antenna[dBi]}$. This antenna was fed with a signal at the spurious frequency $P_{Gen[dBm]}$. The level of the signal was adjusted to repeat the previously measured level. The resulting EIRP is the signal level fed to the reference antenna corrected for gain referenced to an isotropic.

The formula below was used to calculate the EIRP of the EUT.

$$P_{EIRP[dbm]} = P_{Gen[dbm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

6.5.6 Test Results & Limits

Worst case detected emission levels are reported in the following table (refer to spectral plots included on pages 63 for details). The antenna factor and cable loss is according to the manufacturer's specification.

Config A:

Frequency	Maximum Emission Level	Result
[MHz]	[dBm]	
All	More than 20dB below limit -13 dBm	compliant
Measurement Uncertainty:		±5.4dB

Table 6-6: Results – Field Strength of Spurious Radiation (20 MHz Channel BW)

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

6.6 Test No. 6: Frequency Stability (§ 2.1055, § 27.54)

6.6.1 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 (-30°C to +50 °C) and supply voltage conditions according to § 2.1055.

6.6.2 Limits

According to § 27.54, the frequency of the fundamental emission is required to stay within the authorized frequency block, independent of the ambient temperature and the supply voltage.

6.6.3 EUT Operating Condition

The standard setup procedure as described in section 4.3 of this report was used.

6.6.4 Test Configuration

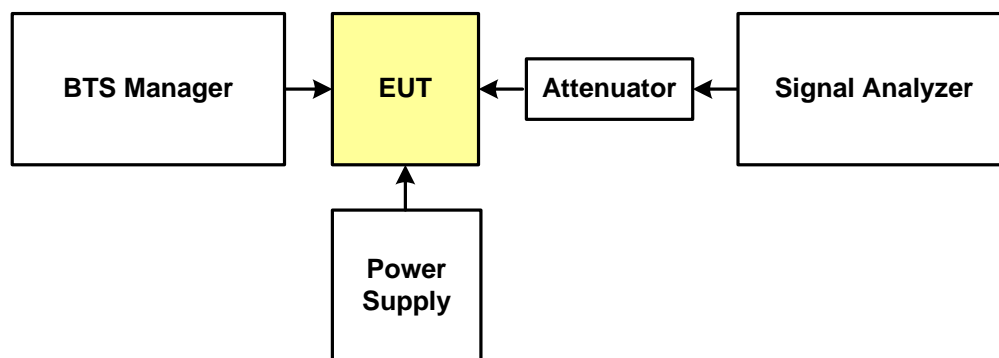


Figure 6-2: Test Configuration for frequency stability with voltage variation

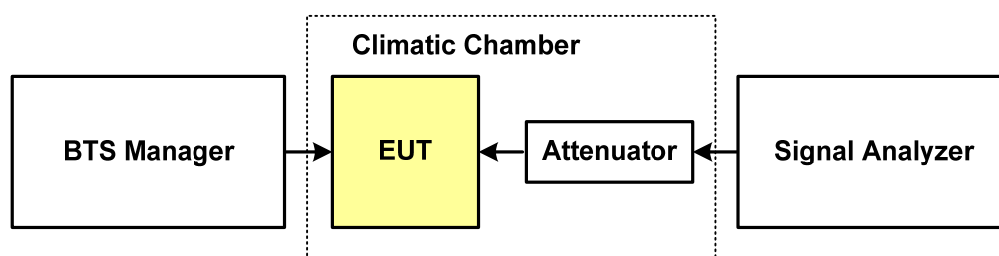


Figure 6-3: Test Configuration for frequency stability with temperature variation

A complete list of the measurement equipment is included on page 26 of this measurement report.

6.6.5 Test Procedure and Results

Frequency Stability with Temperature Variation:

The input voltage to the EUT is set to the nominal value and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees celsius to +50 degrees celsius. The EUT is allowed to stabilize at each temperature and the frequency error is measured.

Config A:

Carrier Frequency: 2132.5 MHz						
Supply Voltage (DC)	Ambient Temperature	Frequency Deviation [ppm]		Manufacturer's Specification		Result
[V]	[°C]	[Hz]	[ppm]	[Hz]	[ppm]	
QPSK Modulation TX1						
-48.0	-30	-7.82	-0.0037	106	0.05	compliant
-48.0	-20	-7.13	-0.0033	106	0.05	compliant
-48.0	-10	-10.80	-0.0051	106	0.05	compliant
-48.0	0	-7.55	-0.0035	106	0.05	compliant
-48.0	+10	-3.89	-0.0018	106	0.05	compliant
-48.0	+30	17.67	0.0083	106	0.05	compliant
-48.0	+40	9.48	0.0044	106	0.05	compliant
-48.0	+50	34.04	0.0160	106	0.05	compliant
QPSK Modulation TX2						
-48.0	-30	-7.23	-0.0034	106	0.05	compliant
-48.0	-20	-8.54	-0.0040	106	0.05	compliant
-48.0	-10	-11.51	-0.0054	106	0.05	compliant
-48.0	0	-7.86	-0.0037	106	0.05	compliant
-48.0	+10	-6.11	-0.0029	106	0.05	compliant
-48.0	+30	17.94	0.0084	106	0.05	compliant
-48.0	+40	9.48	0.0048	106	0.05	compliant
-48.0	+50	36.15	0.0170	106	0.05	compliant
16QAM Modulation TX1						
-48.0	-30	-8.96	-0.0042	106	0.05	compliant
-48.0	-20	-8.53	-0.0040	106	0.05	compliant
-48.0	-10	-12.76	-0.0060	106	0.05	compliant
-48.0	0	-8.78	-0.0041	106	0.05	compliant
-48.0	+10	-4.20	-0.0020	106	0.05	compliant
-48.0	+30	17.75	0.0083	106	0.05	compliant
-48.0	+40	10.52	0.0049	106	0.05	compliant
-48.0	+50	35.53	0.0167	106	0.05	compliant
16QAM Modulation TX2						
-48.0	-30	-7.45	-0.0035	106	0.05	compliant
-48.0	-20	-8.90	-0.0042	106	0.05	compliant
-48.0	-10	-13.96	-0.0065	106	0.05	compliant
-48.0	0	-8.08	-0.0038	106	0.05	compliant
-48.0	+10	-4.14	-0.0019	106	0.05	compliant
-48.0	+30	19.02	0.0089	106	0.05	compliant
-48.0	+40	10.70	0.0050	106	0.05	compliant
-48.0	+50	34.05	0.0160	106	0.05	compliant

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Carrier Frequency: 2132.5 MHz						
Supply Voltage (DC)	Ambient Temperature	Frequency Deviation [ppm]		Manufacturer's Specification		Result
[V]	[°C]	[Hz]	[ppm]	[Hz]	[ppm]	
64QAM Modulation TX1						
-48.0	-30	-9.97	-0.0047	106	0.05	compliant
-48.0	-20	-8.80	-0.0041	106	0.05	compliant
-48.0	-10	-13.21	-0.0062	106	0.05	compliant
-48.0	0	-7.87	-0.0037	106	0.05	compliant
-48.0	+10	-4.75	-0.0022	106	0.05	compliant
-48.0	+30	17.01	0.0080	106	0.05	compliant
-48.0	+40	9.30	0.0044	106	0.05	compliant
-48.0	+50	36.13	0.0169	106	0.05	compliant
64QAM Modulation TX2						
-48.0	-30	-9.88	-0.0046	106	0.05	compliant
-48.0	-20	-8.46	-0.0040	106	0.05	compliant
-48.0	-10	-12.80	-0.0060	106	0.05	compliant
-48.0	0	-8.31	-0.0039	106	0.05	compliant
-48.0	+10	-3.54	-0.0017	106	0.05	compliant
-48.0	+30	17.66	0.0083	106	0.05	compliant
-48.0	+40	10.51	0.0049	106	0.05	compliant
-48.0	+50	34.98	0.0164	106	0.05	compliant
Measurement Uncertainty:					±1.0 Hz	

Table 6-7: Results – Frequency stability with temp. var. (20 MHz Channel BW)

Frequency Stability with Voltage Variation:

The EUT is placed in a climatic chamber and allowed to stabilize at +20 degrees celsius for at least 15 minutes. With the voltage input to the EUT set to 85% of the nominal value, the frequency error is measure. This procedure is repeated at 100% and 115% of the nominal value.

Config A:

Carrier Frequency: 2132.5 MHz						
Supply Voltage (DC)	Ambient Temperature	Frequency Deviation [ppm]		Manufacturer's Specification		Result
[V]	[°C]	[Hz]	[ppm]	[Hz]	[ppm]	
QPSK Modulation TX1						
-40.8	+20	9.21	0.0043	106	0.05	compliant
-48.0	+20	8.33	0.0039	106	0.05	compliant
-55.2	+20	9.51	0.0045	106	0.05	compliant
QPSK Modulation TX2						
-40.8	+20	9.56	0.0045	106	0.05	compliant
-48.0	+20	10.11	0.0047	106	0.05	compliant
-55.2	+20	7.73	0.0036	106	0.05	compliant
16QAM Modulation TX1						
-40.8	+20	8.72	0.0041	106	0.05	compliant
-48.0	+20	9.58	0.0045	106	0.05	compliant
-55.2	+20	8.16	0.0038	106	0.05	compliant
16QAM Modulation TX2						
-40.8	+20	7.38	0.0035	106	0.05	compliant
-48.0	+20	7.93	0.0037	106	0.05	compliant
-55.2	+20	8.79	0.0041	106	0.05	compliant
64QAM Modulation TX1						
-40.8	+20	8.46	0.0040	106	0.05	compliant
-48.0	+20	7.38	0.0035	106	0.05	compliant
-55.2	+20	8.77	0.0041	106	0.05	compliant
64QAM Modulation TX2						
-40.8	+20	9.76	0.0046	106	0.05	compliant
-48.0	+20	7.79	0.0037	106	0.05	compliant
-55.2	+20	6.48	0.0030	106	0.05	compliant
Measurement Uncertainty:					±1.0 Hz	

Table 6-8: Results – Frequency stability with voltage var. (20 MHz Channel BW)

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

7 Test Data and Screenshots

7.1 Part List of the RF Measurement Test Equipment

No.	Test Equipment	Type (Manufacturer)	Serial Number	Calibration date	Calibration due	Test No.
1	Network Analyzer	Hewlett-Packard: HP8753E	US38431868	06/2010	06/2011	1, 2, 3, 4, 6
2	Network Analyzer	Hewlett-Packard: HP8753ES	US39172107	06/2010	06/2011	1, 2, 3, 4, 6
3	Calibration kit	Hewlett-Packard: HP85032B	2919A04843	06/2010	06/2011	1, 2, 3, 4, 6
4	Signal Generator	Rohde & Schwarz: SMP 04	845401/001	07/2010	07/2012	1, 2, 3, 4, 6
5	DC power	Sörensen: SGI 80/188	0525A00546	cnn	cnn	1, 2, 3, 4, 6
6	Signal Analyzer	Rohde & Schwarz: FSQ 26	100364	01/2010	01/2011	1, 2, 3, 4, 6
7	Frequency Standard	Datum 8040	0041005473	03/2010	03/2011	6
8	Temperature/humidity meter	VAISALA: HMI 31	P3730008	03/2010	03/2011	1, 2, 3, 4, 5, 6
9	Environmental chamber	Weiss technick	DU22/500/80	06/2010	06/2011	6
10	Attenuator	Spinner: 527736	86962	cnn	cnn	4
11	Attenuator	Spinner: 531251	27034	cnn	cnn	4
12	Attenuator	Weinschel: 1433	MG798	cnn	cnn	4
13	Attenuator	Spinner: 531212	22589A	cnn	cnn	4
14	Attenuator	Spinner: 531212	22589B	cnn	cnn	4
15	Attenuator	Narda: 769-30	08275	cnn	cnn	1, 2, 3, 4, 6
16	Attenuator	Weinschel: 67-20-33	BM0633	cnn	cnn	4
17	Attenuator	Weinschel: 66-20-34	BM6886	cnn	cnn	4
18	High pass filter	Reactel: 9HSX-3/20-S11	0531	cnn	cnn	4
19	Combiner	Weinschel: 1870A	6275	cnn	cnn	4
20	Semianechoic chamber	Siemens Matsushita 9m × 5m × 6m (room 0039)	B83317-C6019-T232	08/2008	08/2011	5
21	EMI Test Receiver	R&S ESIB 26	100335	07/2010	07/2011	5
22	Horn Antenna	Emco 3115	00075697	06/2010	06/2011	5
23	Bilog Antenna	Chase CBL6112B	2694	07/2010	07/2011	5
24	Log Periodic Antenna	R&S HL025	356749/012	07/2010	07/2011	5
25	Signal Generator	R&S SMR 20	832428/030	07/2010	07/2011	5
26	Amplifier	Miteq AFSX4	791117	cnn	cnn	5
27	Antenna Mast	Deisel HD240	2401323194	cnn	cnn	5
28	Mast Controller	Deisel HD100	1001331	cnn	cnn	5
29	Amplifier	HP 83017A	3123A00444	cnn	cnn	5

Table 7-1: Part List of the RF Measurement Test Equipment

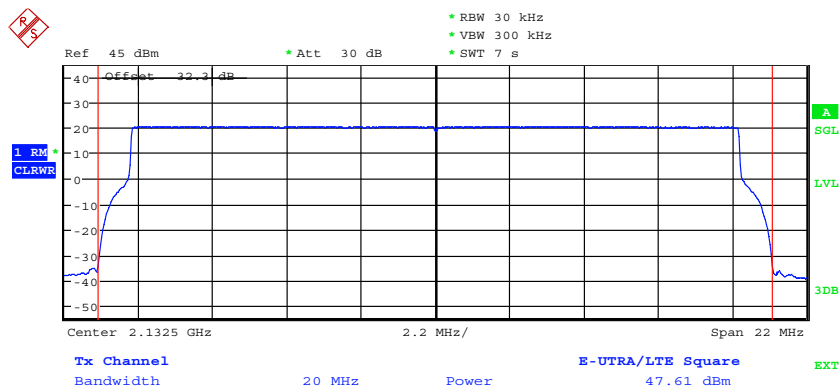
The test report shall not be reproduced except in full without the written approval of the testing laboratory

7.2 Spectral Plots

7.2.1 Test No. 1: RF Power Output

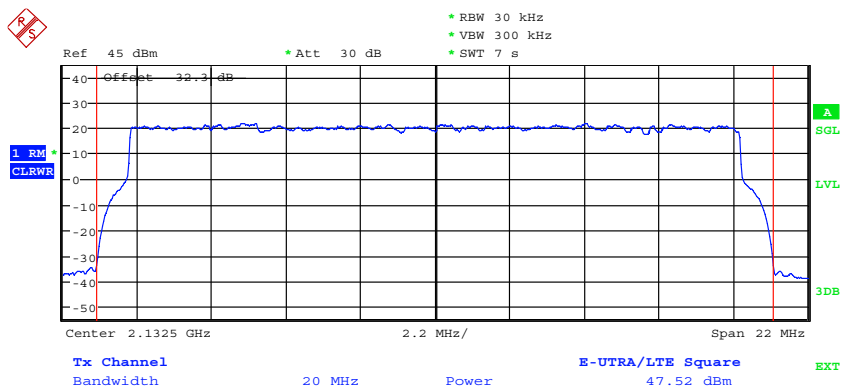
The value 'CH PWR' is the carrier power measured by the signal analyzer. 'REF PWR' (and also 'Offset') is the external attenuation (cable loss of the test set up). The sum of both values is base station maximum output power given on page 11. The external attenuation is frequency dependant. Thus the various 'Offset' values in the screenshots may differ.

Config A TX1:



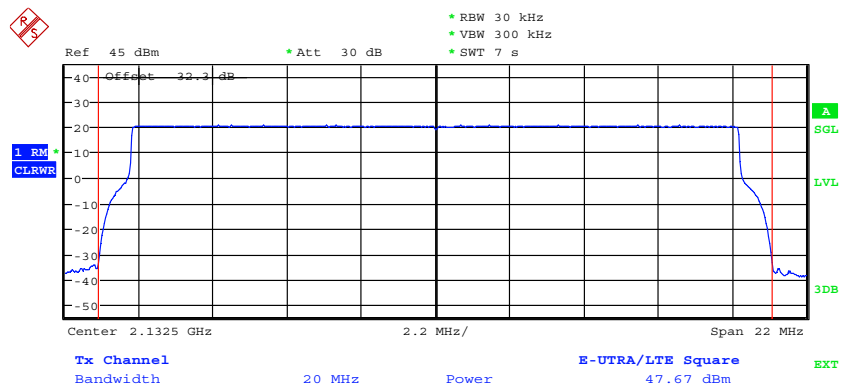
Date: 25.AUG.2010 13:50:51

**Figure 7-1: Maximum Output Power at the Antenna Connector
QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 25.AUG.2010 13:52:33

**Figure 7-2: Maximum Output Power at the Antenna Connector
16QAM (2132.5 MHz) (20MHz Channel BW)**

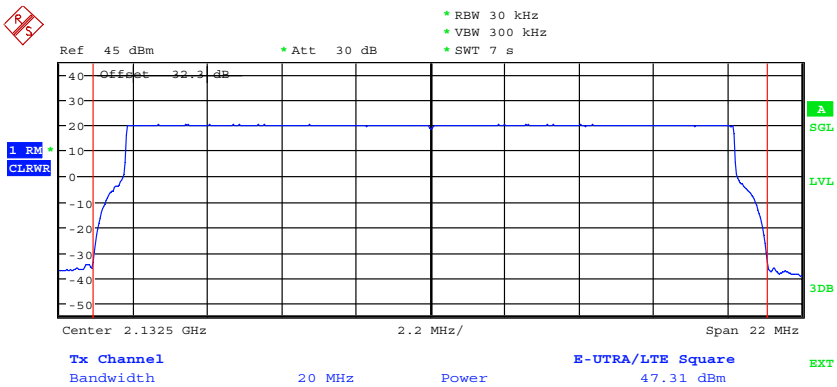


Date: 25.AUG.2010 13:57:11

**Figure 7-3: Maximum Output Power at the Antenna Connector
64QAM (2132.5 MHz) (20MHz Channel BW)**

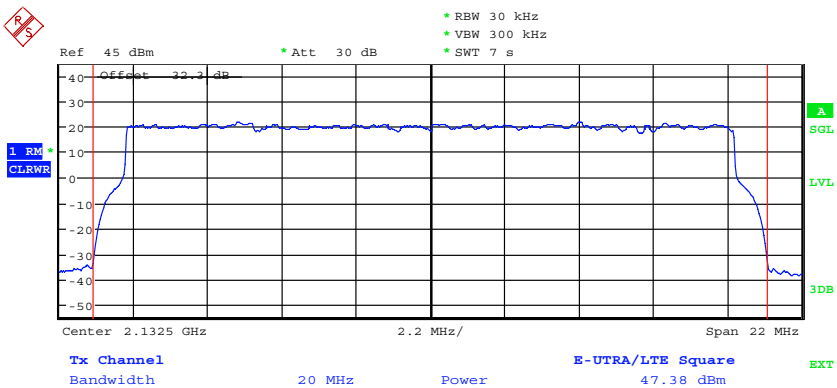
The test report shall not be reproduced except in full without the written approval of the testing laboratory

Config A TX2:



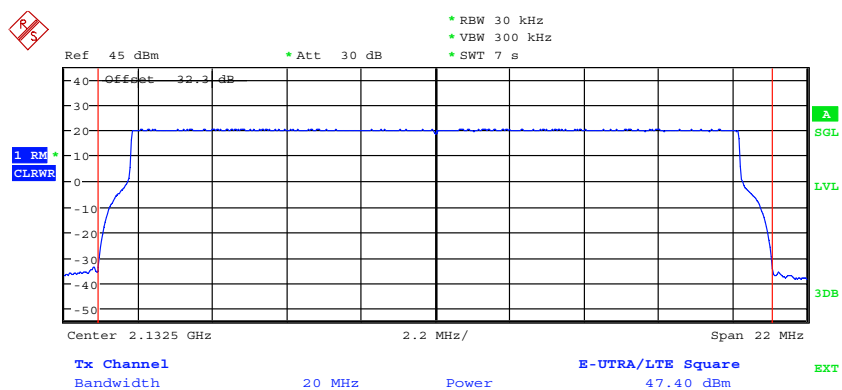
Date: 25.AUG.2010 13:59:03

Figure 7-4: Maximum Output Power at the Antenna Connector
QPSK (2132.5 MHz) (20MHz Channel BW)



Date: 25.AUG.2010 13:59:55

Figure 7-5: Maximum Output Power at the Antenna Connector
16QAM (2132.5 MHz) (20MHz Channel BW)



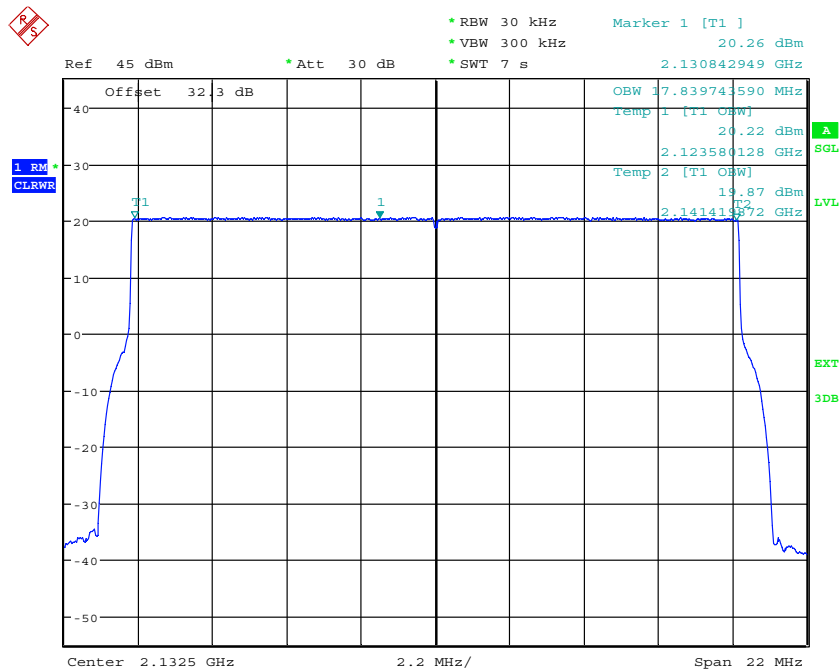
Date: 25.AUG.2010 14:00:54

**Figure 7-6: Maximum Output Power at the Antenna Connector
64QAM (2132.5 MHz) (20MHz Channel BW)**

7.2.2 Test No. 3: Occupied Bandwidth

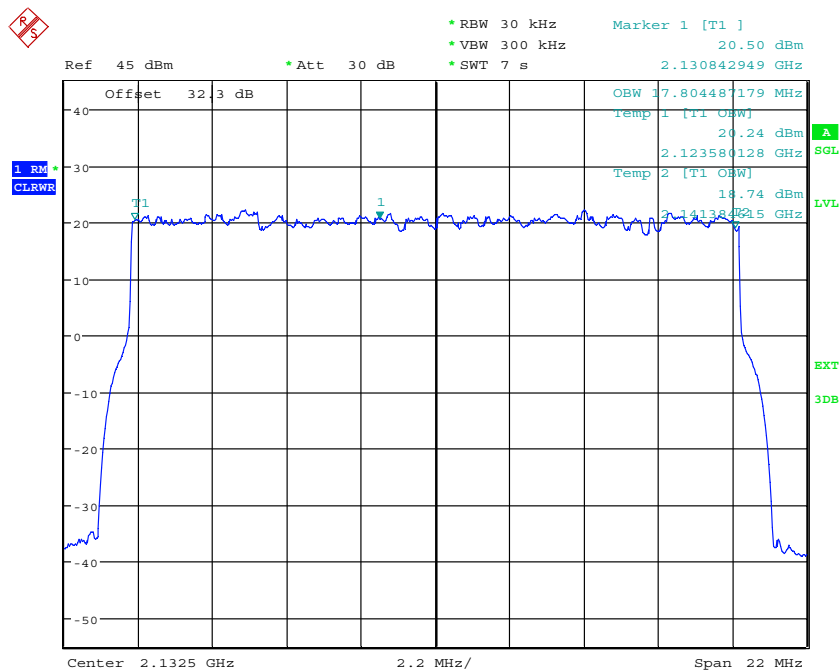
The value 'OBW' is the measured occupied bandwidth.

Config A TX1:



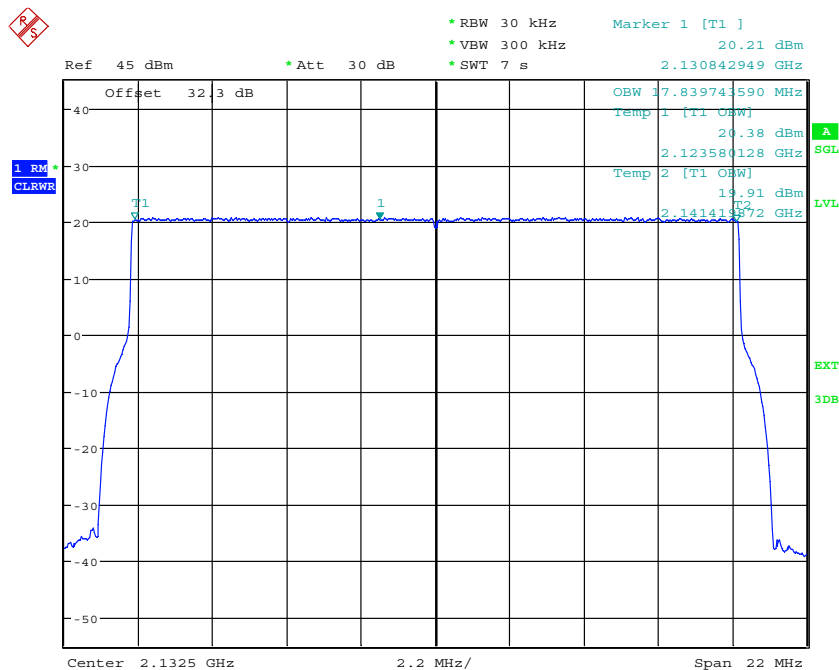
Date: 26.AUG.2010 09:18:49

Figure 7-7: Occupied Bandwidth – QPSK (2132.5 MHz) (20MHz Channel BW)



Date: 26.AUG.2010 09:20:34

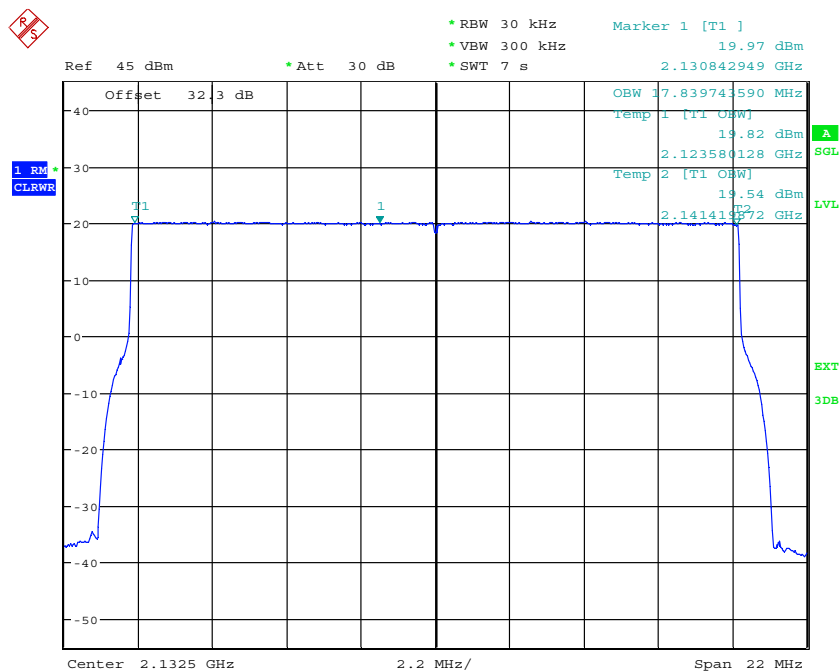
Figure 7-8: Occupied Bandwidth – 16QAM (2132.5 MHz) (20MHz Channel BW)



Date: 26.AUG.2010 09:22:20

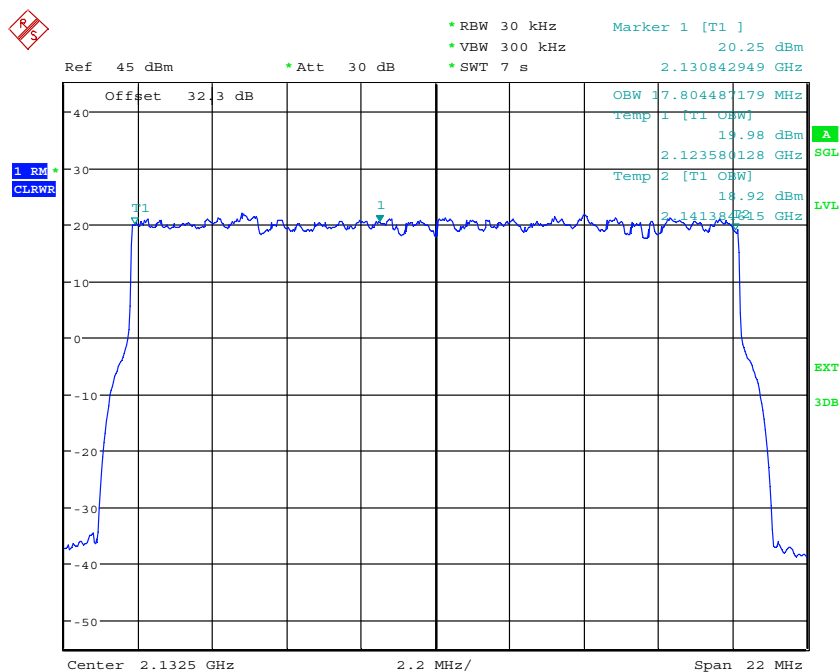
Figure 7-9: Occupied Bandwidth – 64QAM (2132.5 MHz) (20MHz Channel BW)

Config A TX2:



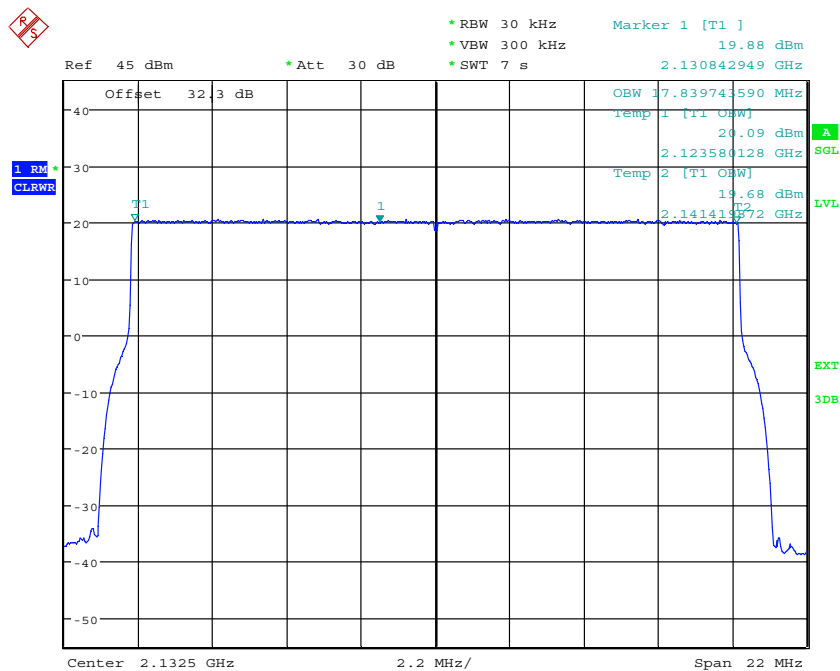
Date: 26.AUG.2010 09:24:53

Figure 7-10: Occupied Bandwidth – QPSK (2132.5 MHz) (20MHz Channel BW)



Date: 26.AUG.2010 09:26:27

Figure 7-11: Occupied Bandwidth – 16QAM (2132.5 MHz) (20MHz Channel BW)



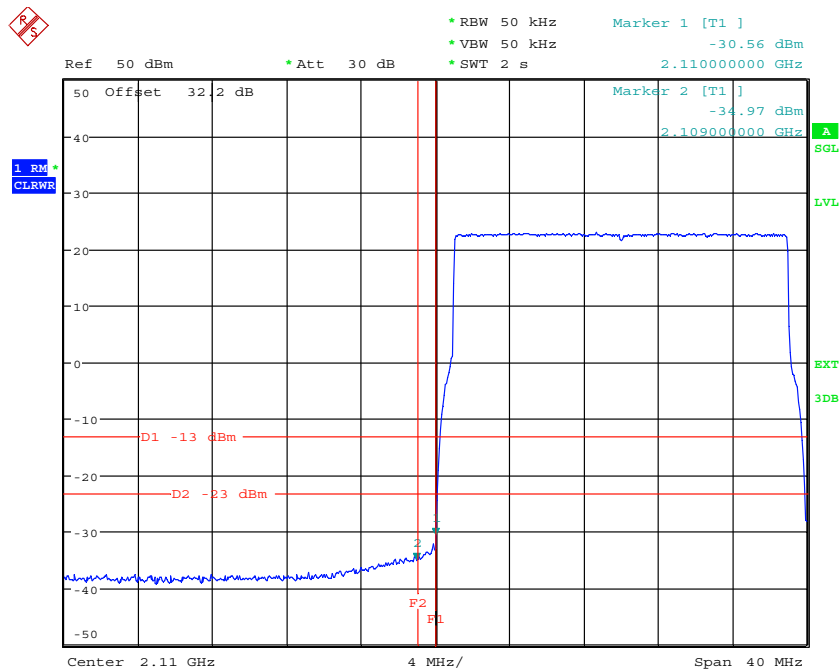
Date: 26.AUG.2010 09:27:47

Figure 7-12: Occupied Bandwidth – 64QAM (2132.5 MHz) (20MHz Channel BW)

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

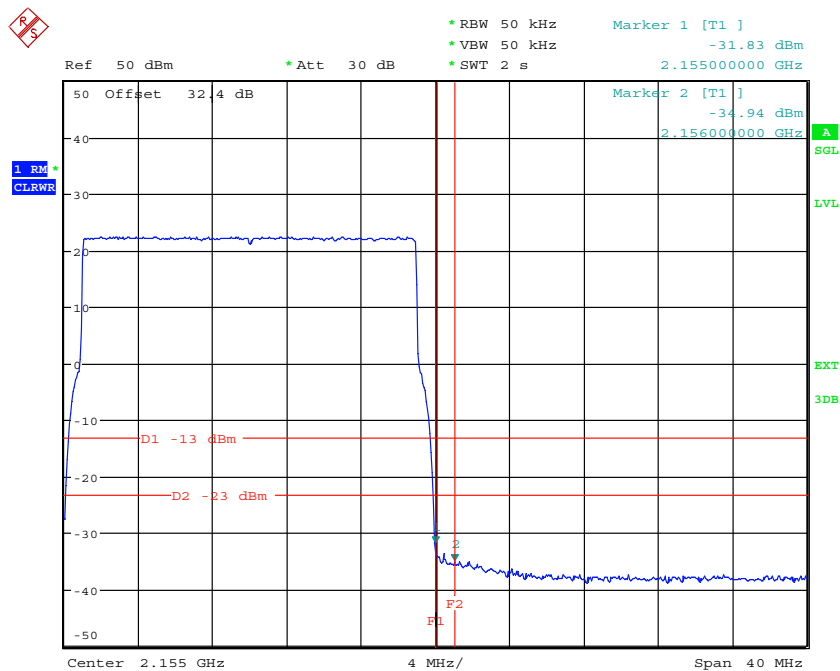
The external attenuation (cable loss of the setup) can be seen as the 'Offset' value in the screenshots. The external attenuation is frequency dependant. Thus the various 'Offset' values in the screenshots may differ.

Config A TX1:



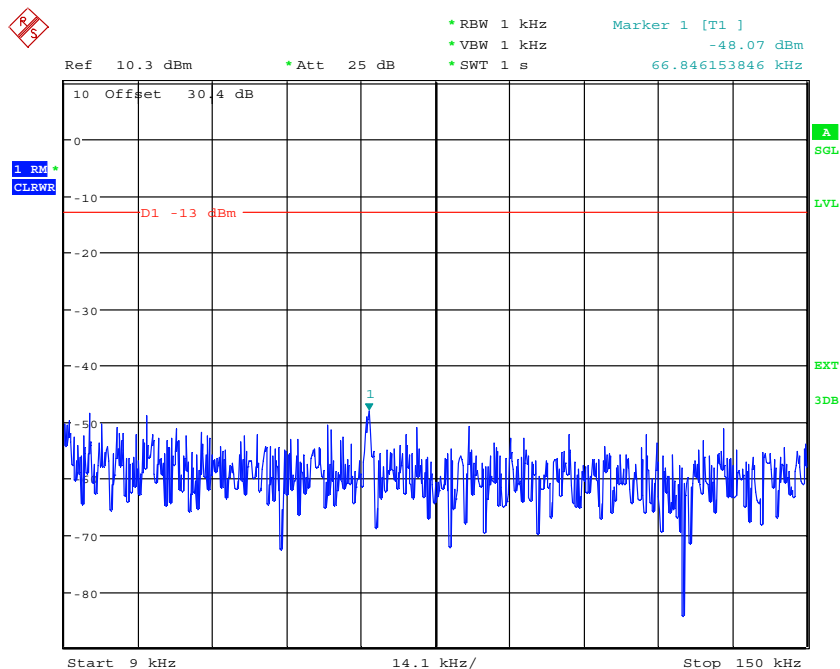
Date: 30.AUG.2010 11:26:43

**Figure 7-13: Spurious Emissions (Lower band edge)
– QPSK (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:15:50

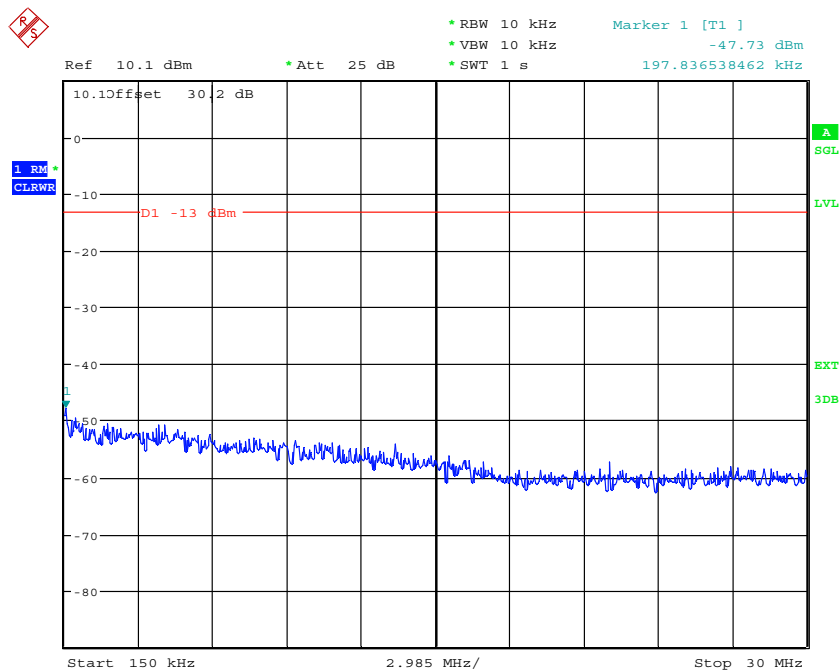
**Figure 7-14: Spurious Emissions (Upper band edge)
– QPSK (2145 MHz) (20MHz Channel BW)**



Date: 13.OCT.2010 13:10:56

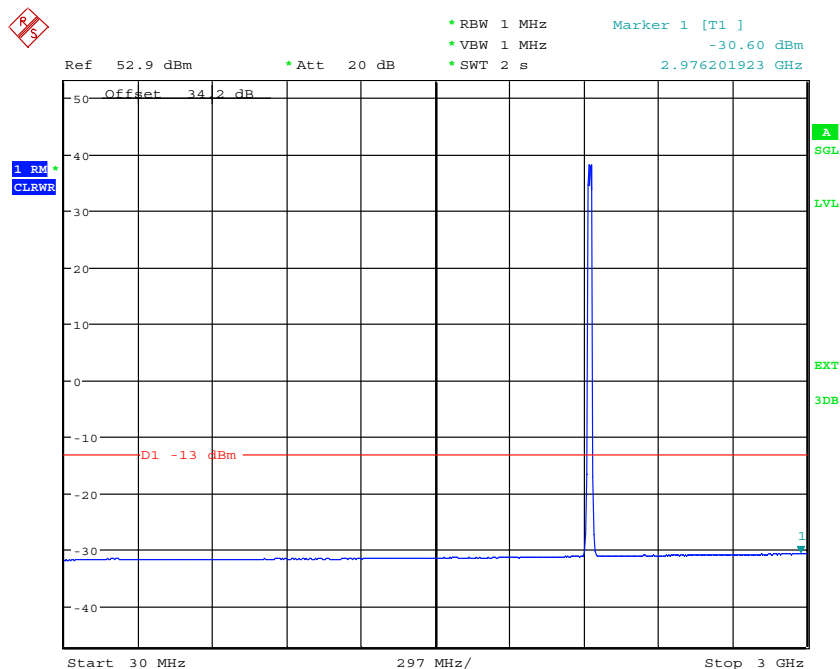
**Figure 7-15: Spurious Emissions (9kHz-150kHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 13:05:24

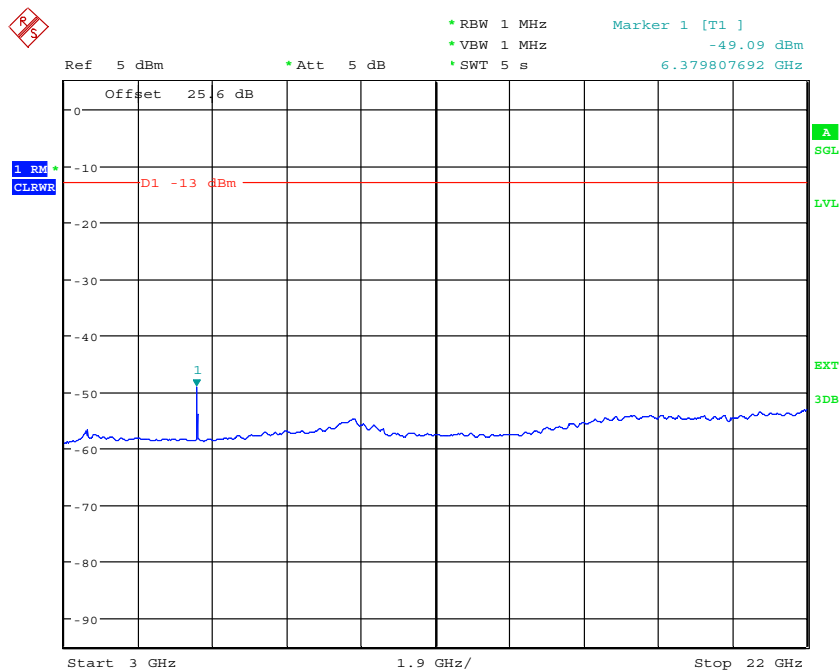
**Figure 7-16: Spurious Emissions (150kHz-30MHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 13.OCT.2010 13:18:49

**Figure 7-17: Spurious Emissions (30MHz-3GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

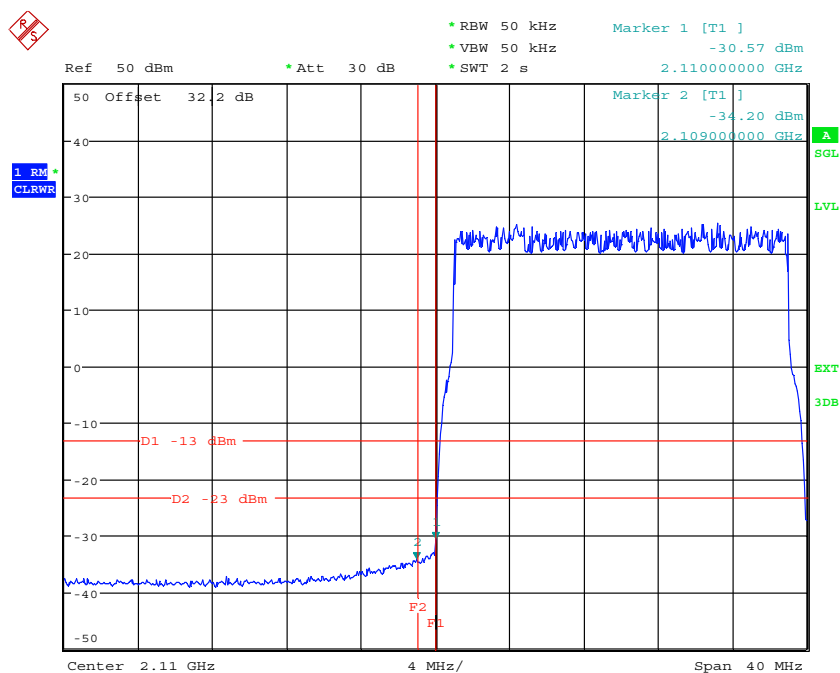
The test report shall not be reproduced except in full without the written approval of the testing laboratory



Date: 26.AUG.2010 14:51:55

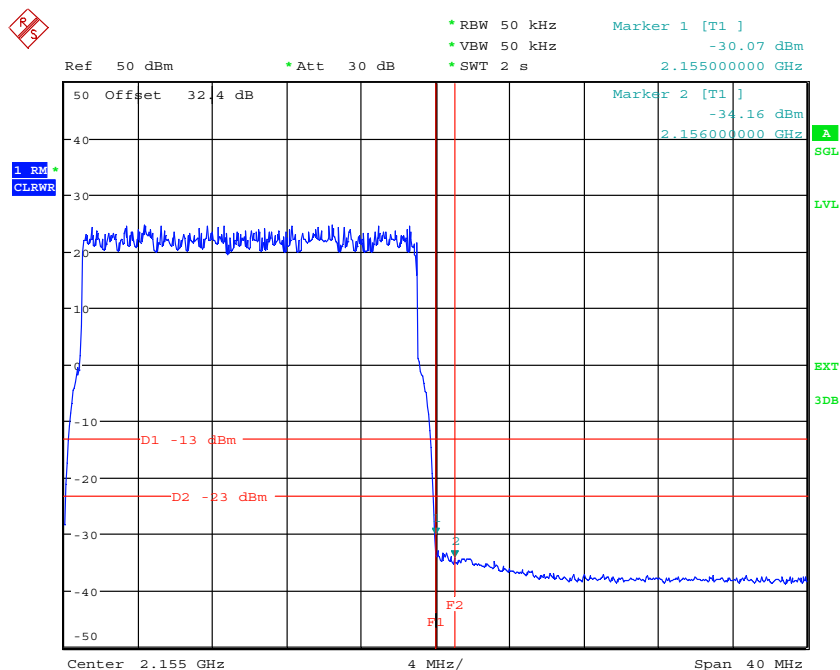
**Figure 7-18: Spurious Emissions (3GHz-22GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

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Date: 30.AUG.2010 11:38:37

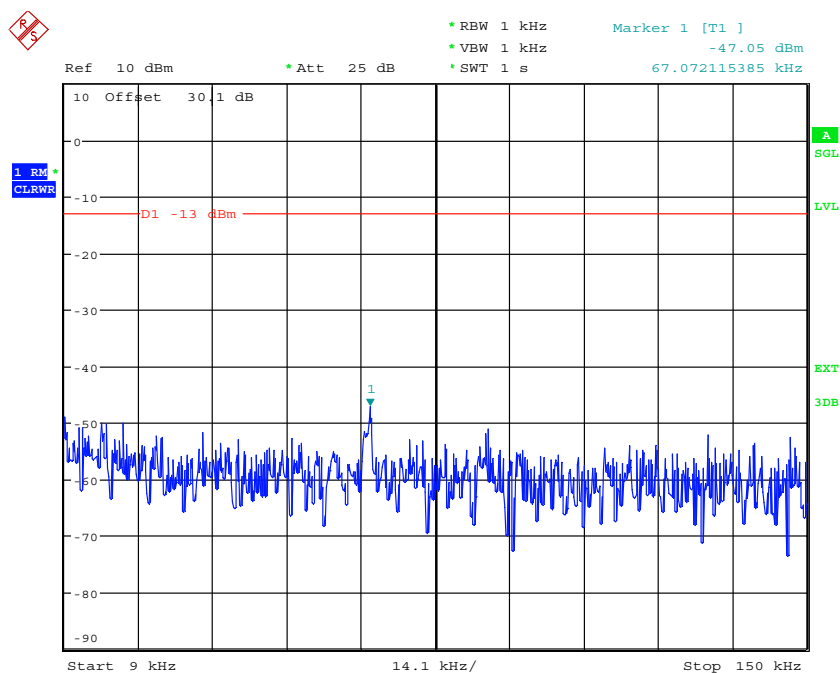
**Figure 7-19: Spurious Emissions (Lower band edge)
– 16QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:17:37

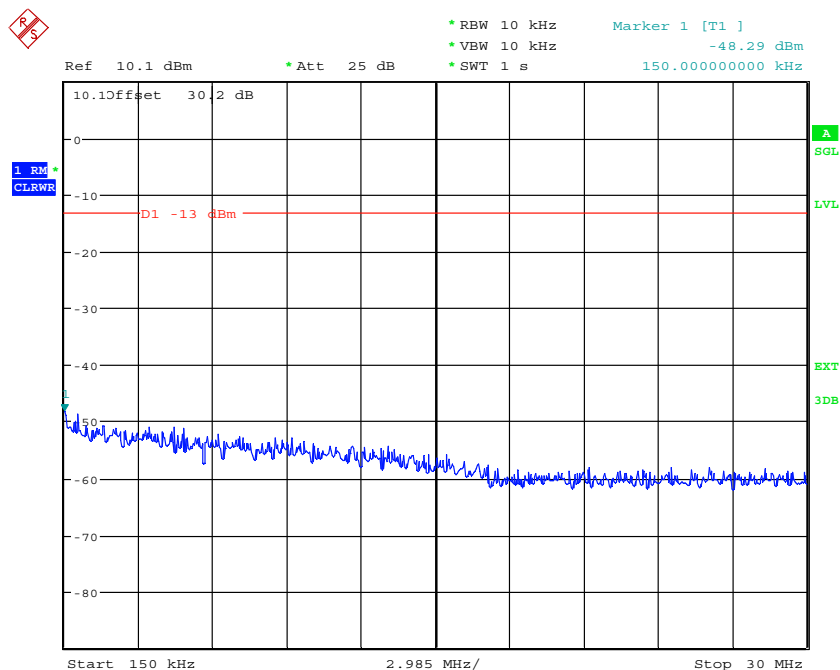
**Figure 7-20: Spurious Emissions (Upper band edge)
– 16QAM (2145 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 11:51:54

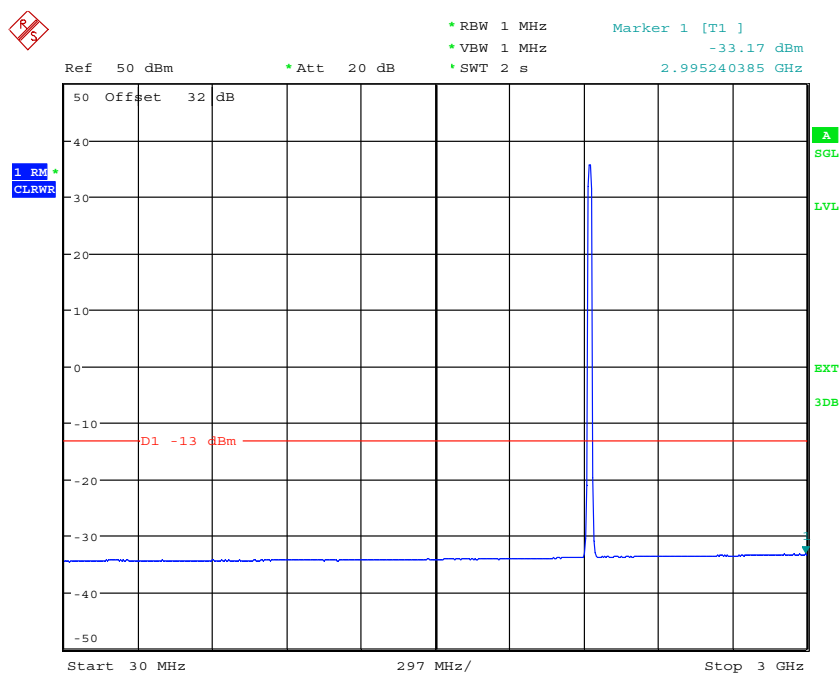
**Figure 7-21: Spurious Emissions (9kHz-150kHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 13:07:11

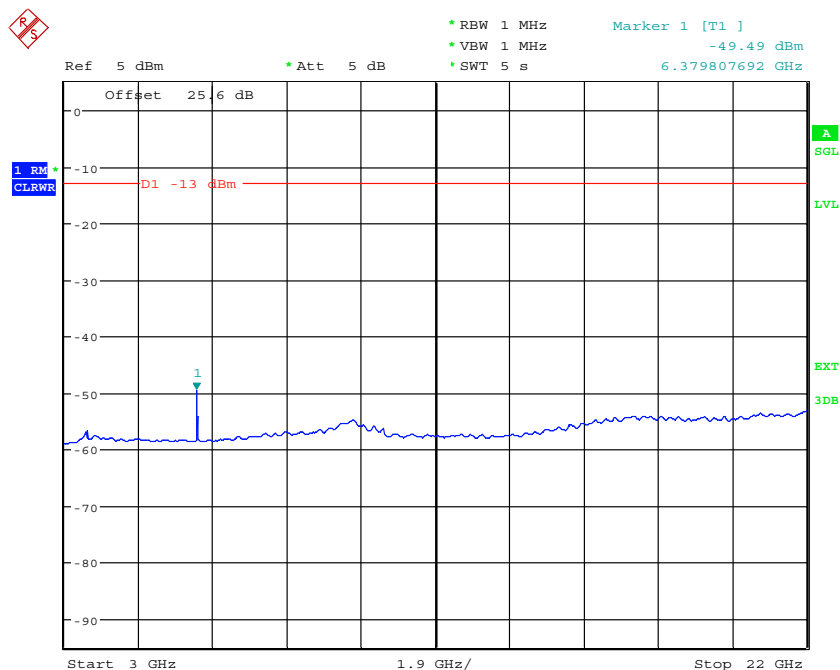
**Figure 7-22: Spurious Emissions (150kHz-30MHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

The test report shall not be reproduced except in full without the written approval of the testing laboratory



Date: 26.AUG.2010 14:25:37

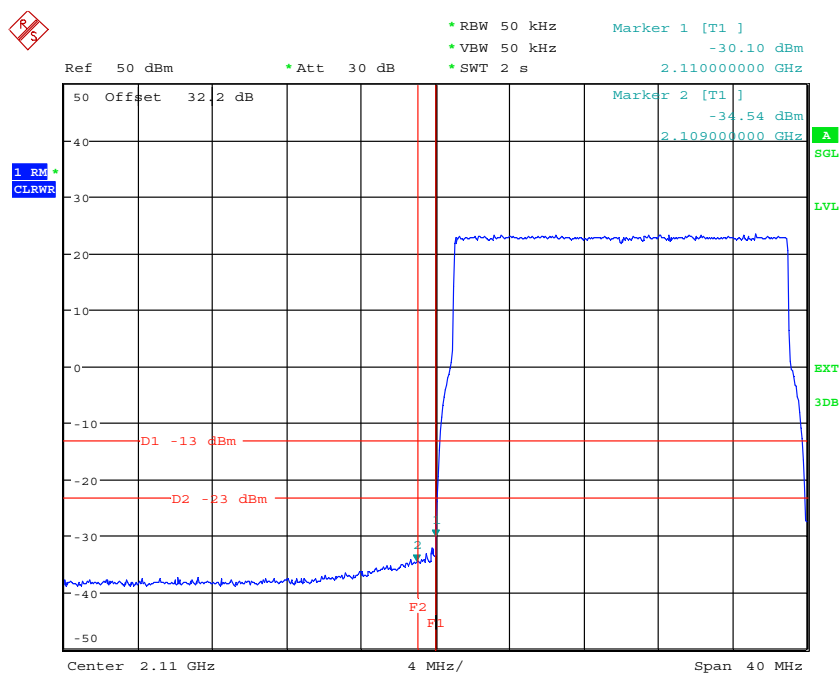
**Figure 7-23: Spurious Emissions (30MHz-3GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 14:53:57

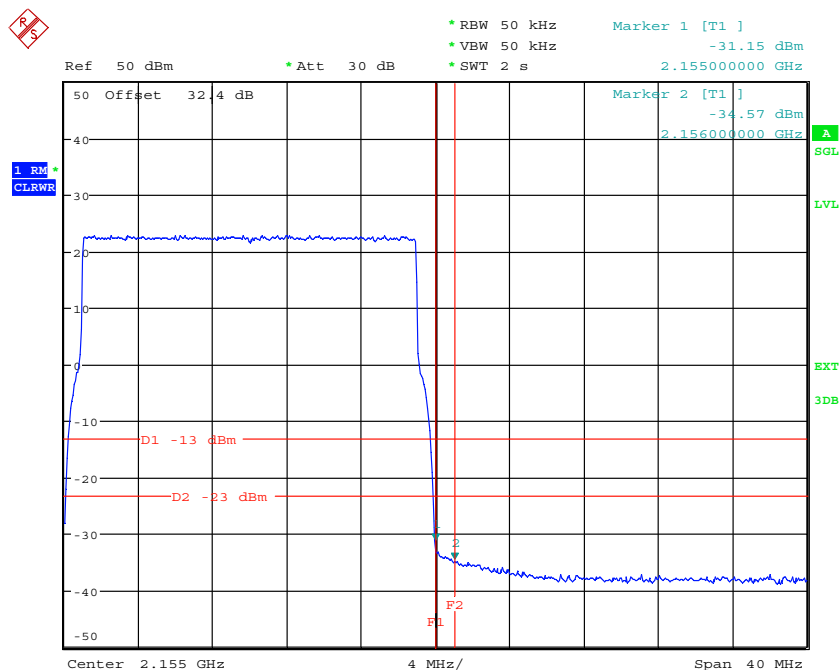
**Figure 7-24: Spurious Emissions (3GHz-22GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

The test report shall not be reproduced except in full without the written approval of the testing laboratory



Date: 30.AUG.2010 11:40:17

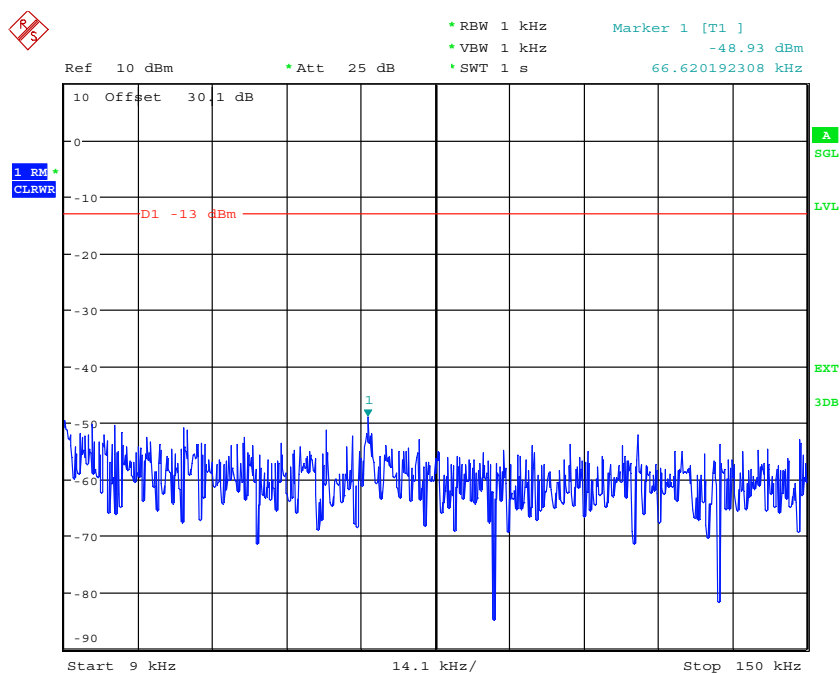
**Figure 7-25: Spurious Emissions (Lower band edge)
– 64QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:19:23

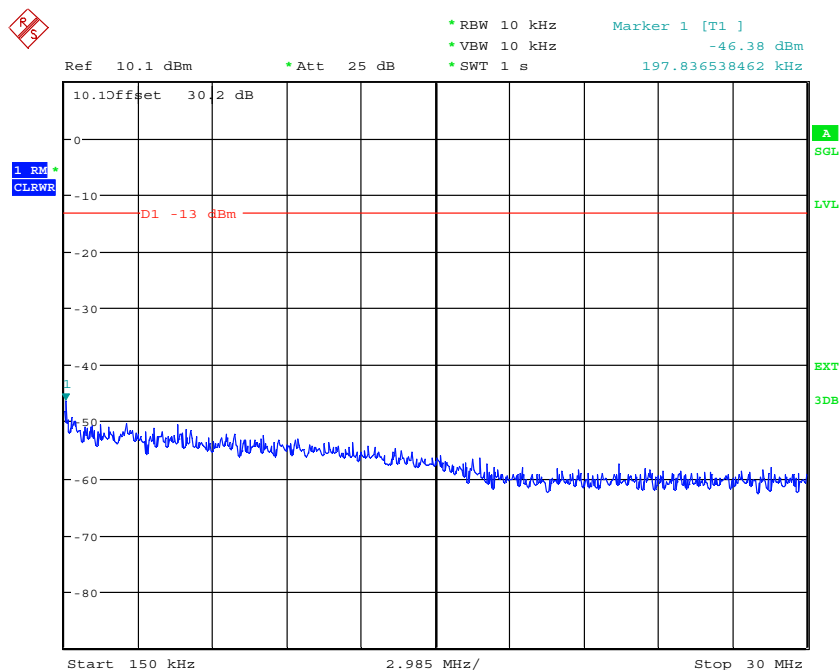
**Figure 7-26: Spurious Emissions (Upper band edge)
– 64QAM (2145 MHz) (20MHz Channel BW)**

The test report shall not be reproduced except in full without the written approval of the testing laboratory



Date: 26.AUG.2010 11:53:33

**Figure 7-27: Spurious Emissions (9kHz-150kHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

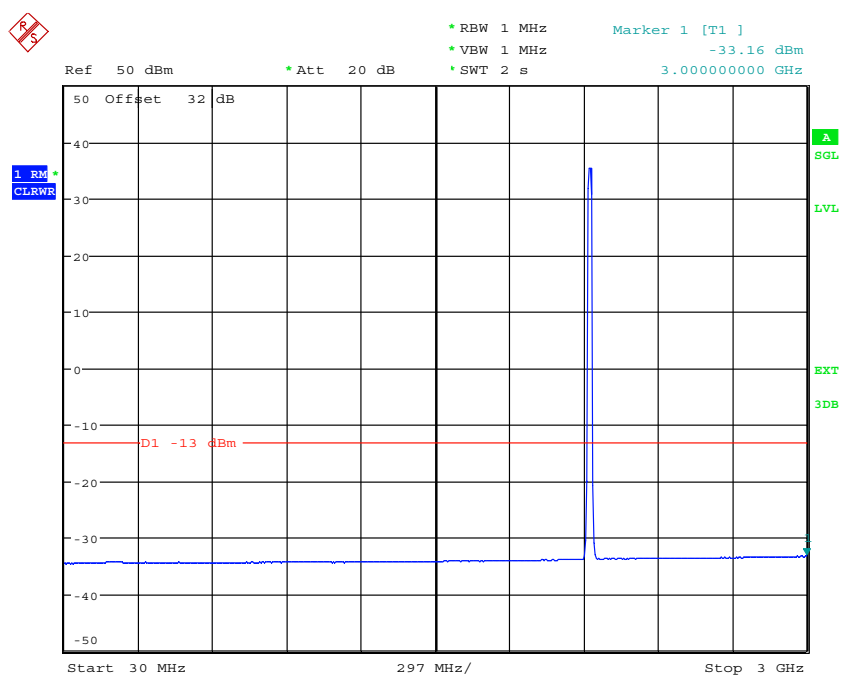


Date: 26.AUG.2010 13:08:26

**Figure 7-28: Spurious Emissions (150kHz-30MHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

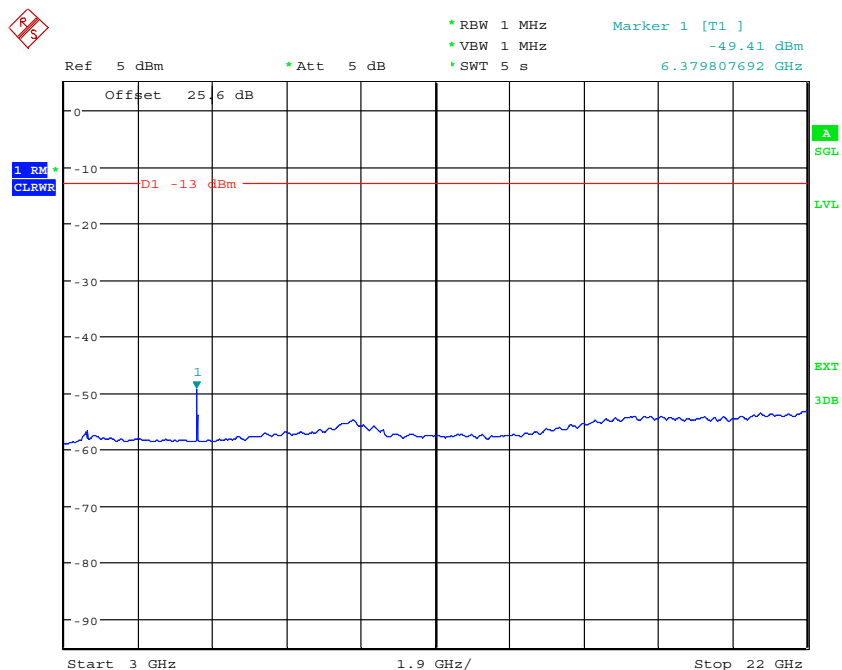
The test report shall not be reproduced except in full without the written approval of the testing laboratory

The test report shall not be reproduced except in full without the written approval of the testing laboratory



Date: 26.AUG.2010 14:28:53

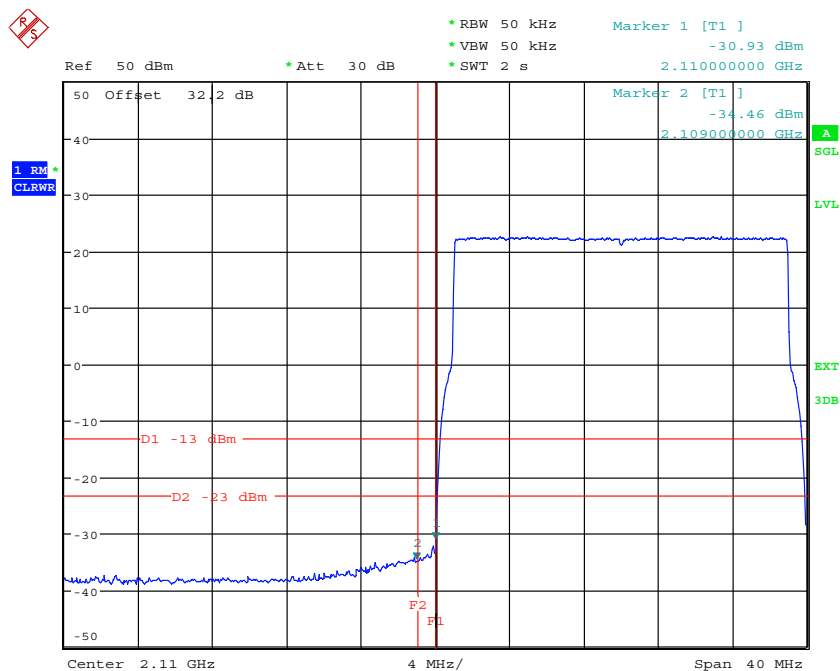
**Figure 7-29: Spurious Emissions (30MHz-3GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 14:55:07

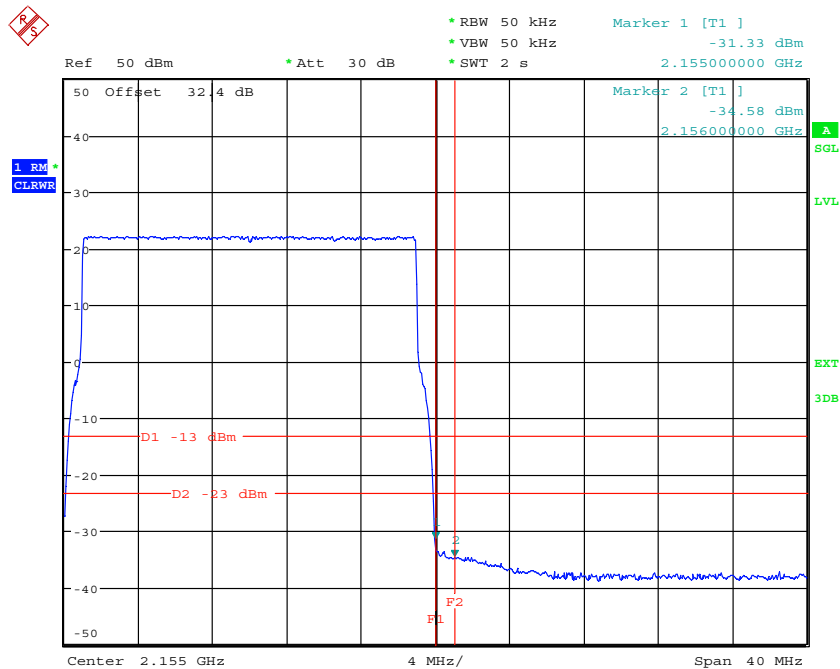
**Figure 7-30: Spurious Emissions (3GHz-22GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

Config A TX2:



Date: 30.AUG.2010 11:46:14

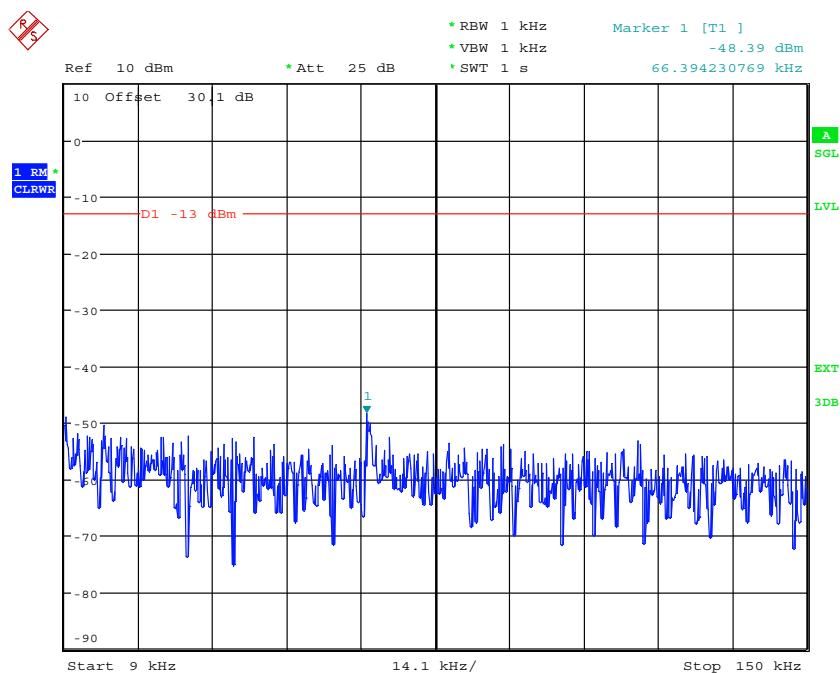
**Figure 7-31: Spurious Emissions (Lower band edge)
– QPSK (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:23:11

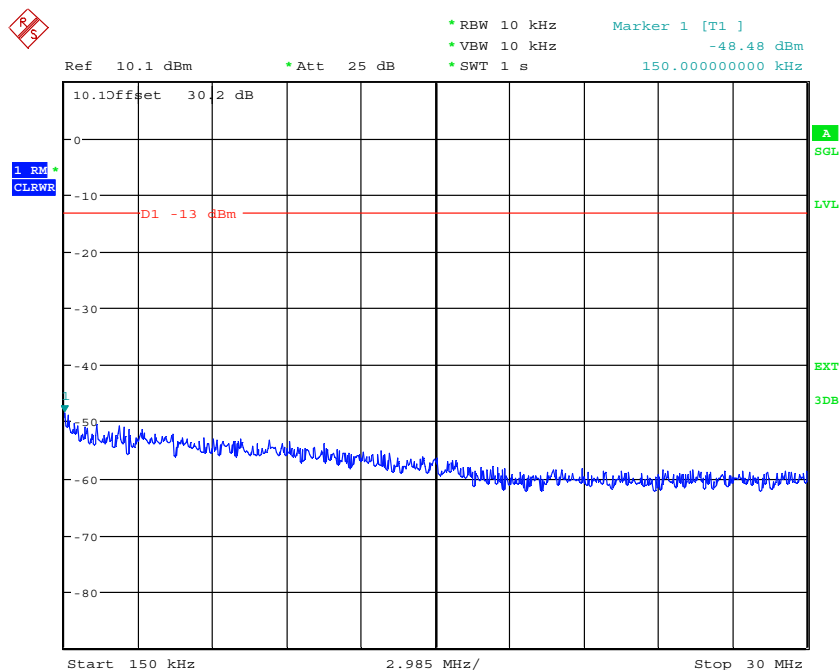
**Figure 7-32: Spurious Emissions (Upper band edge)
– QPSK (2145 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 12:49:55

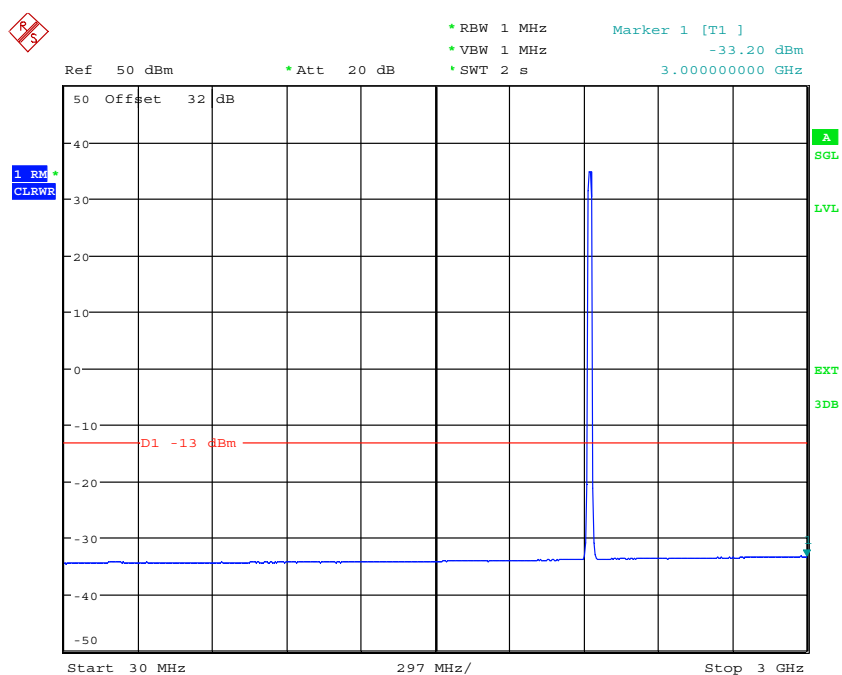
**Figure 7-33: Spurious Emissions (9kHz-150kHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 13:10:51

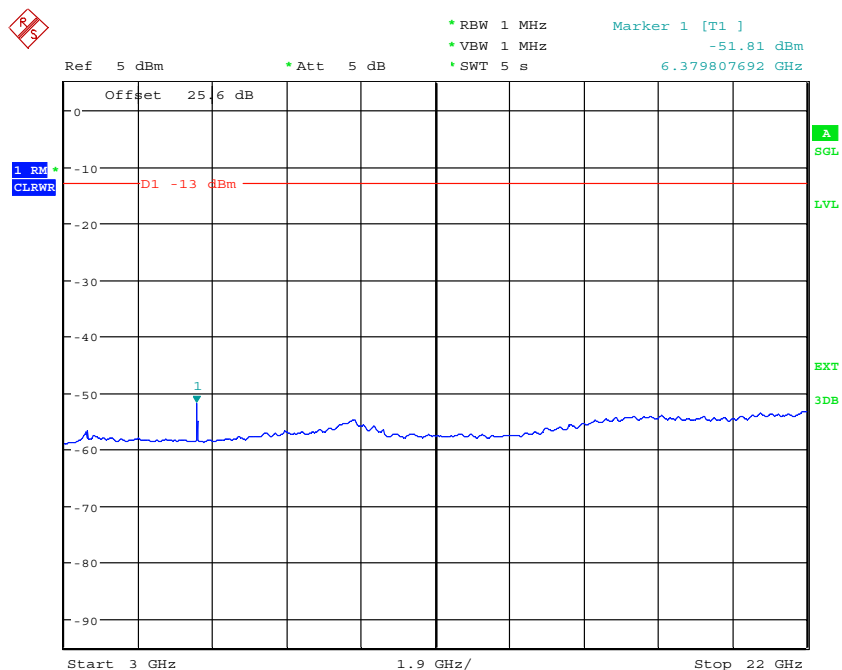
**Figure 7-34: Spurious Emissions (150kHz-30MHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

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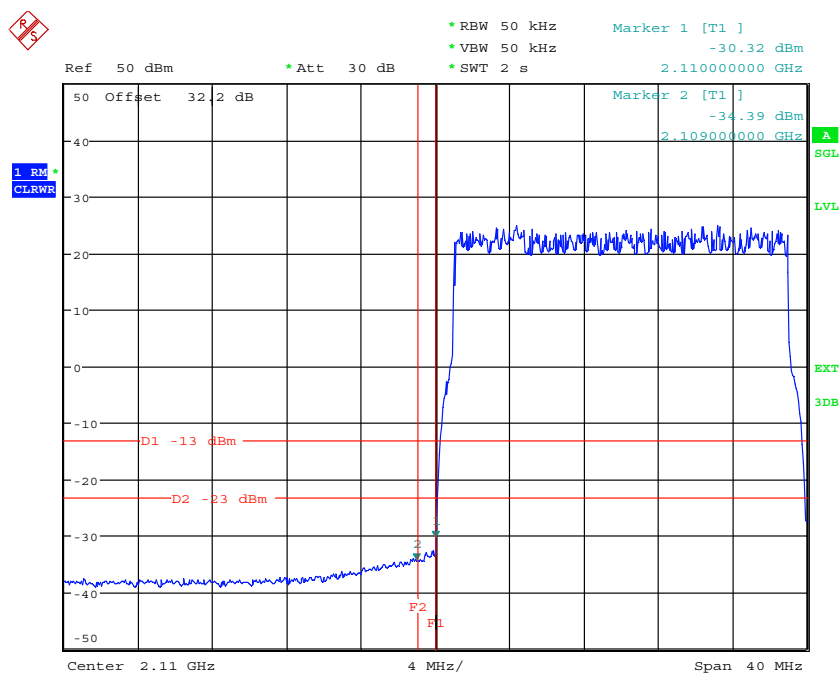
Date: 26.AUG.2010 14:32:25

**Figure 7-35: Spurious Emissions (30MHz-3GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



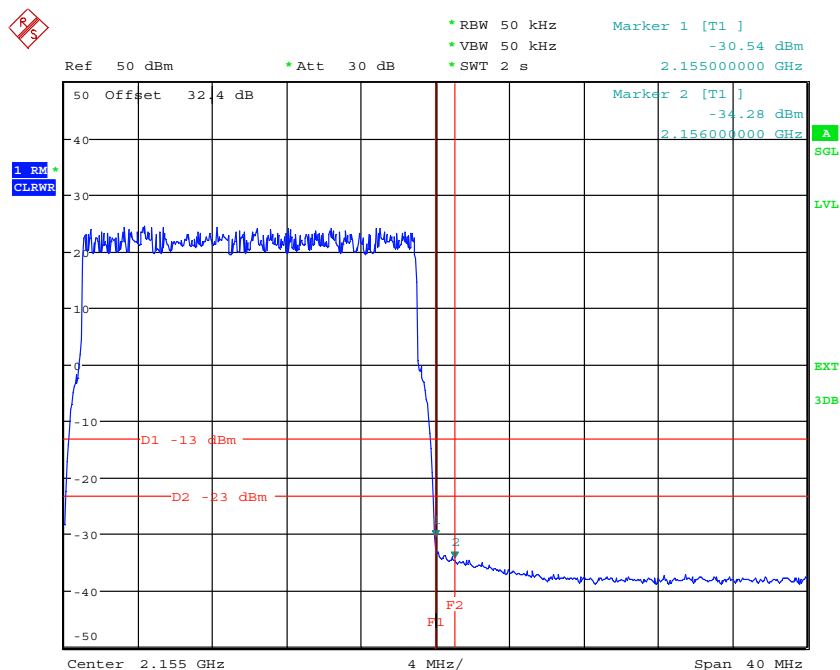
Date: 26.AUG.2010 14:57:00

**Figure 7-36: Spurious Emissions (3GHz-22GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 11:51:06

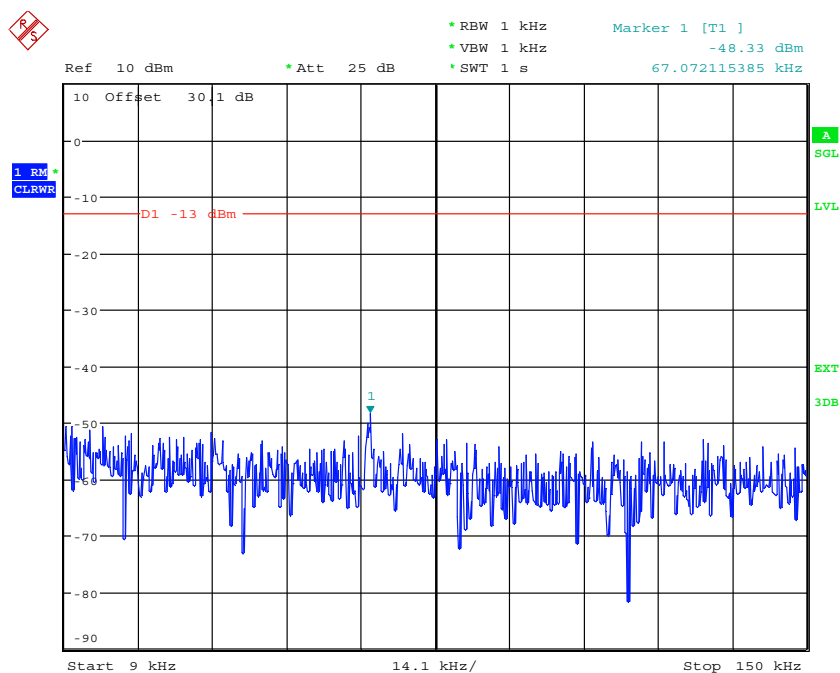
**Figure 7-37: Spurious Emissions (Lower band edge)
– 16QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:25:25

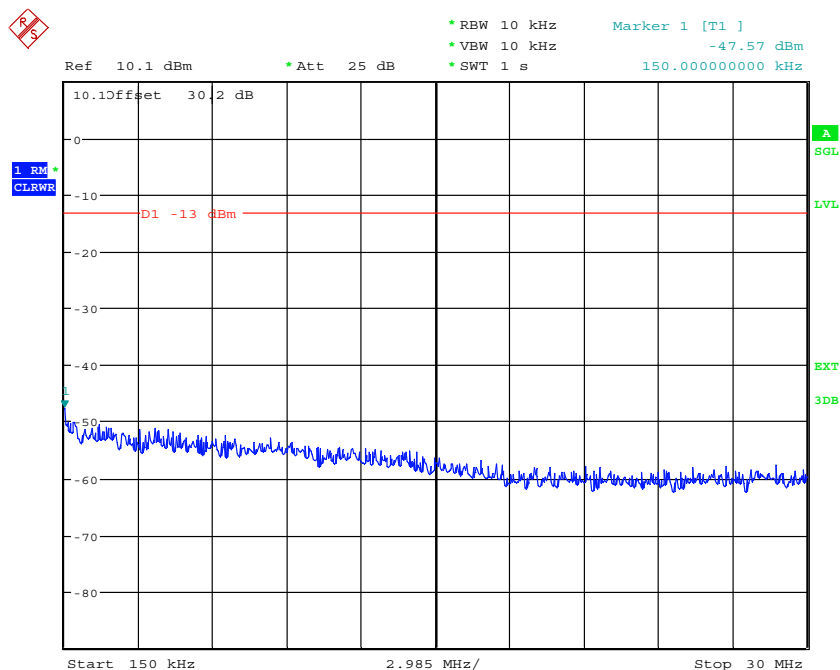
**Figure 7-38: Spurious Emissions (Upper band edge)
– 16QAM (2145 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 12:50:59

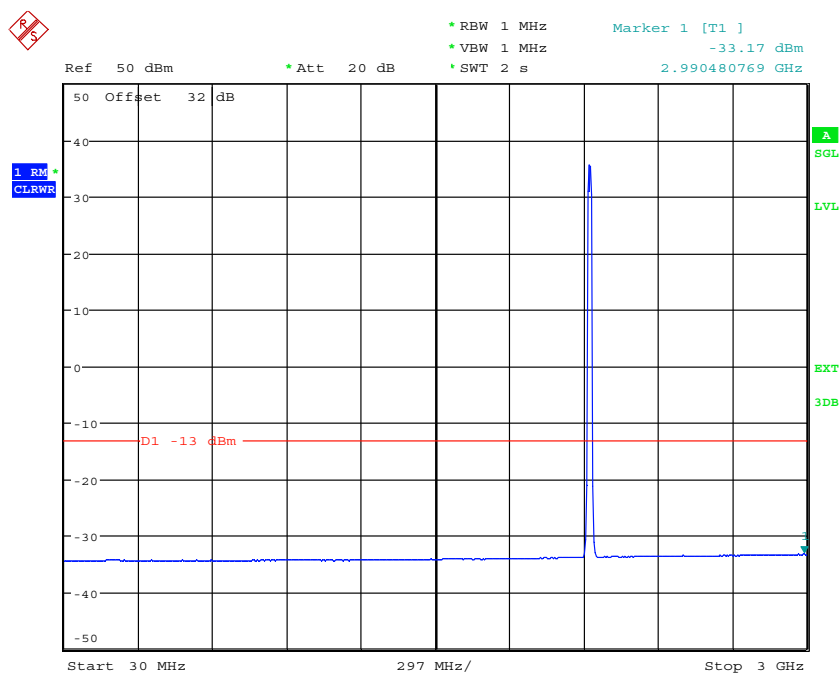
**Figure 7-39: Spurious Emissions (9kHz-150kHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 13:12:03

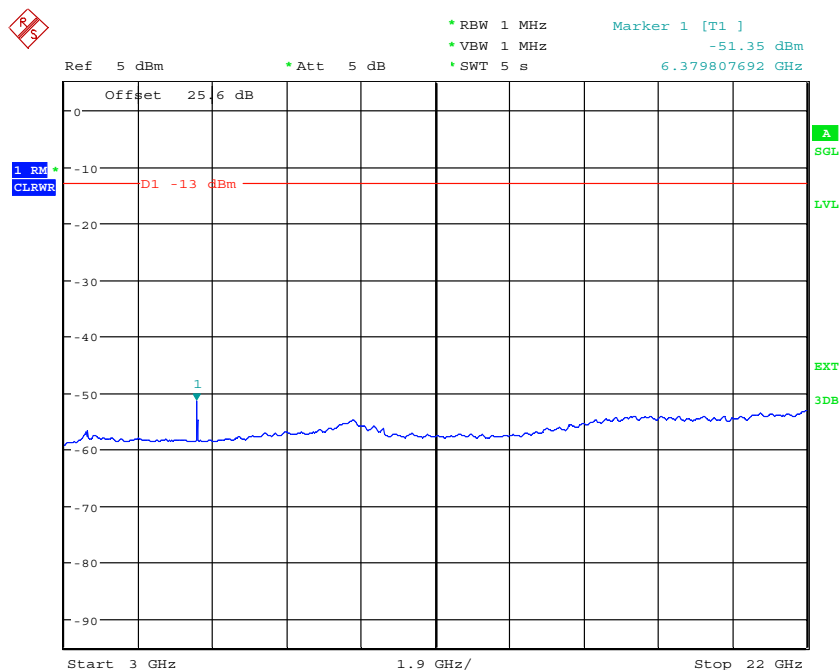
**Figure 7-40: Spurious Emissions (150kHz-30MHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 14:34:27

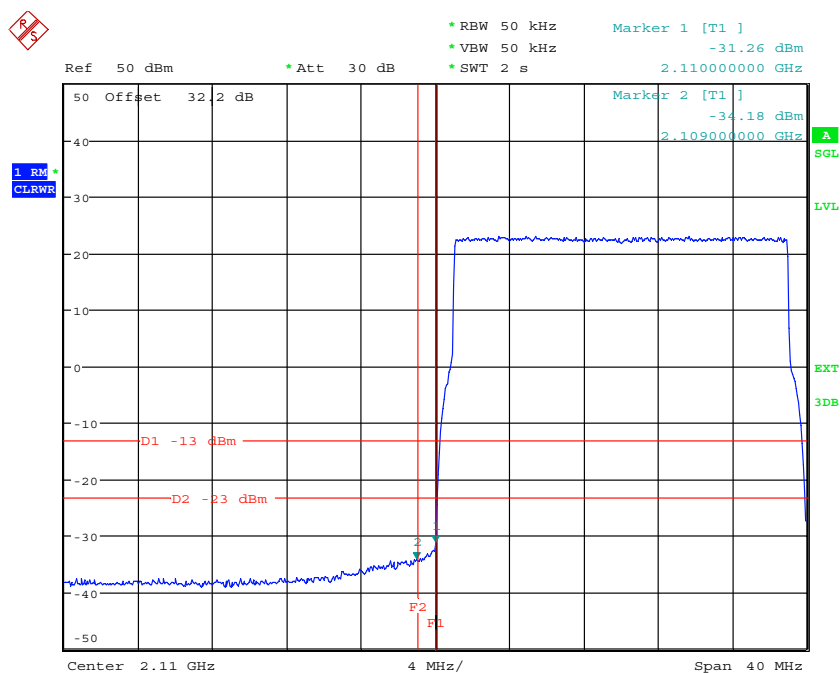
**Figure 7-41: Spurious Emissions (30MHz-3GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 14:59:17

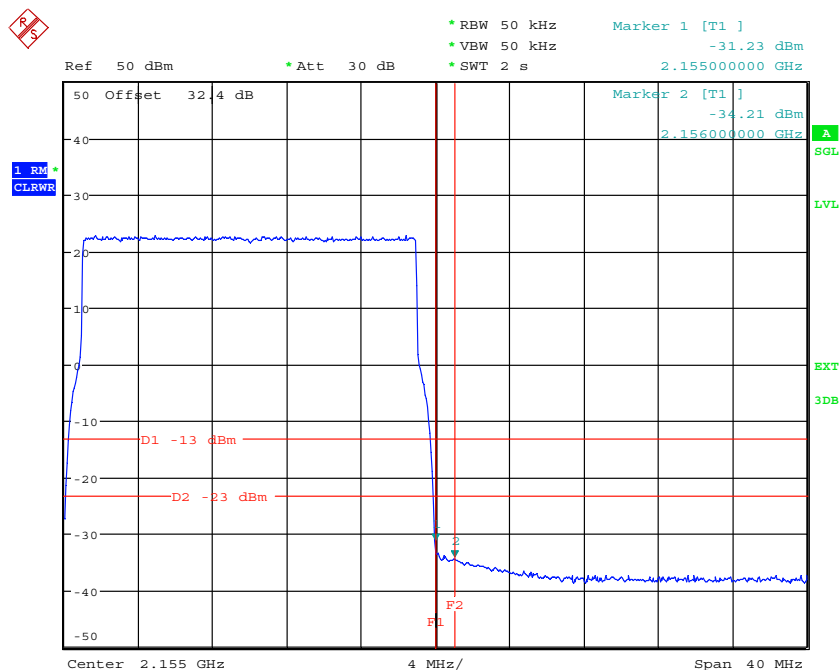
**Figure 7-42: Spurious Emissions (3GHz-22GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 30.AUG.2010 11:52:53

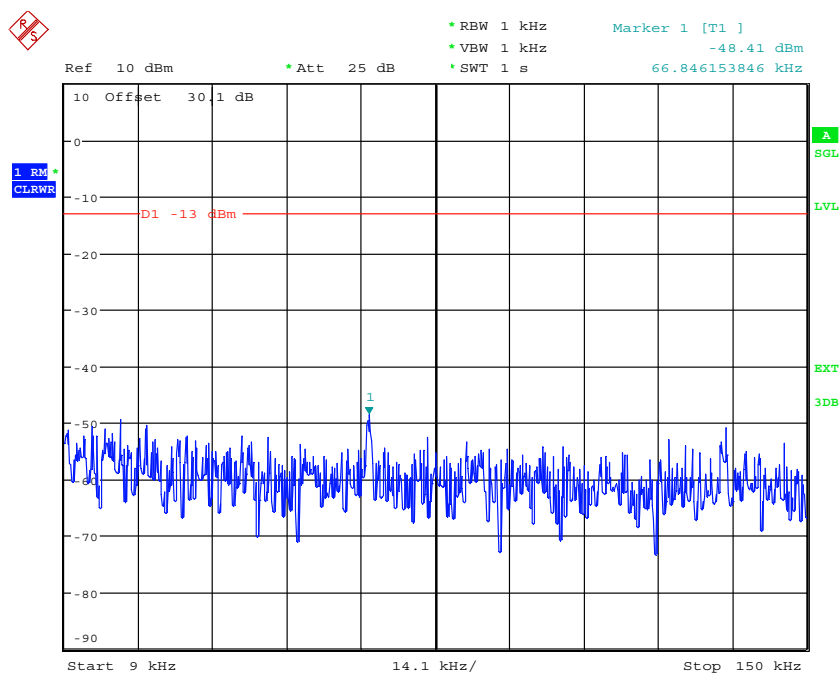
**Figure 7-43: Spurious Emissions (Lower band edge)
– 64QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 13:26:54

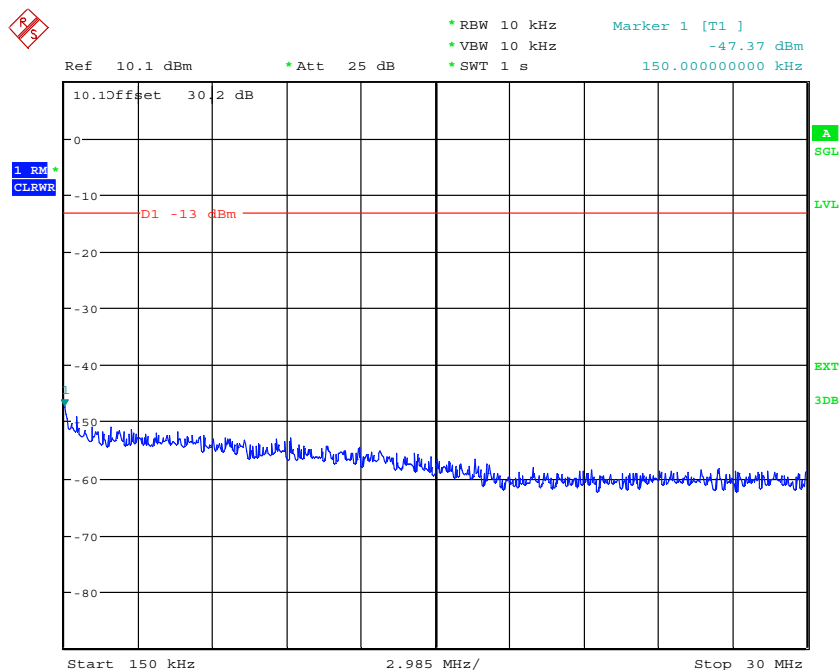
**Figure 7-44: Spurious Emissions (Upper band edge)
– 64QAM (2145 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 12:52:43

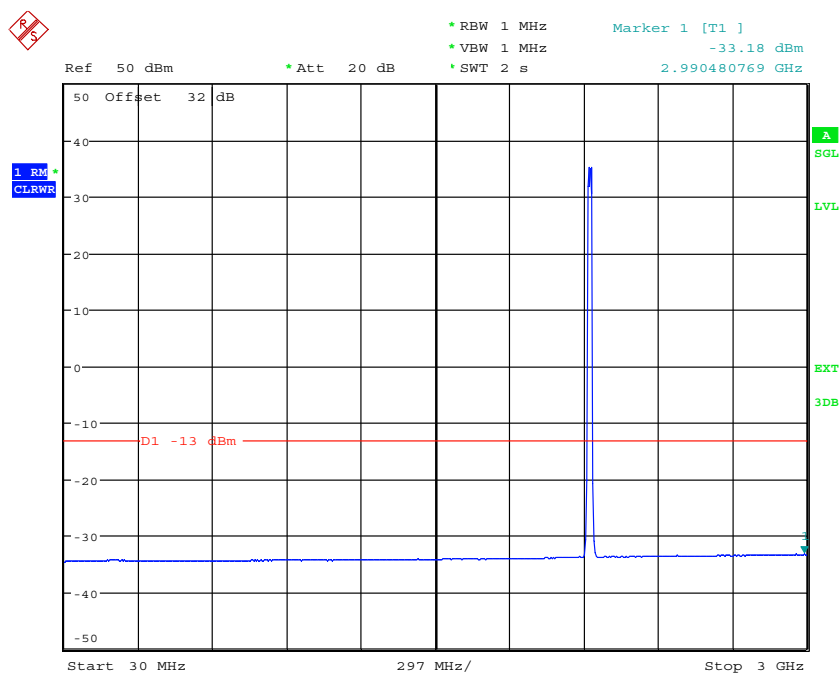
**Figure 7-45: Spurious Emissions (9kHz-150kHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 26.AUG.2010 13:13:43

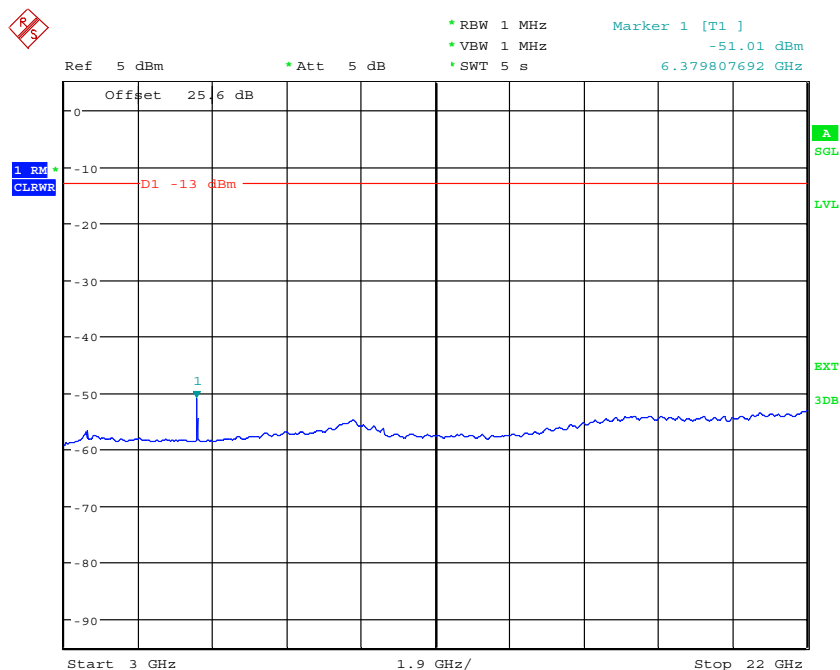
**Figure 7-46: Spurious Emissions (150kHz-30MHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 26.AUG.2010 14:36:21

**Figure 7-47: Spurious Emissions (30MHz-3GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

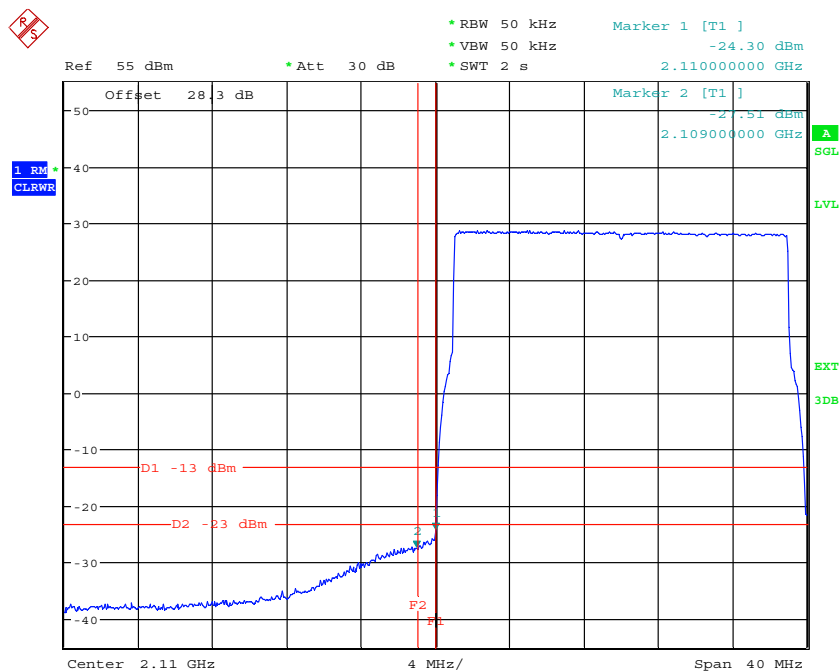


Date: 26.AUG.2010 15:01:48

**Figure 7-48: Spurious Emissions (3GHz-22GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

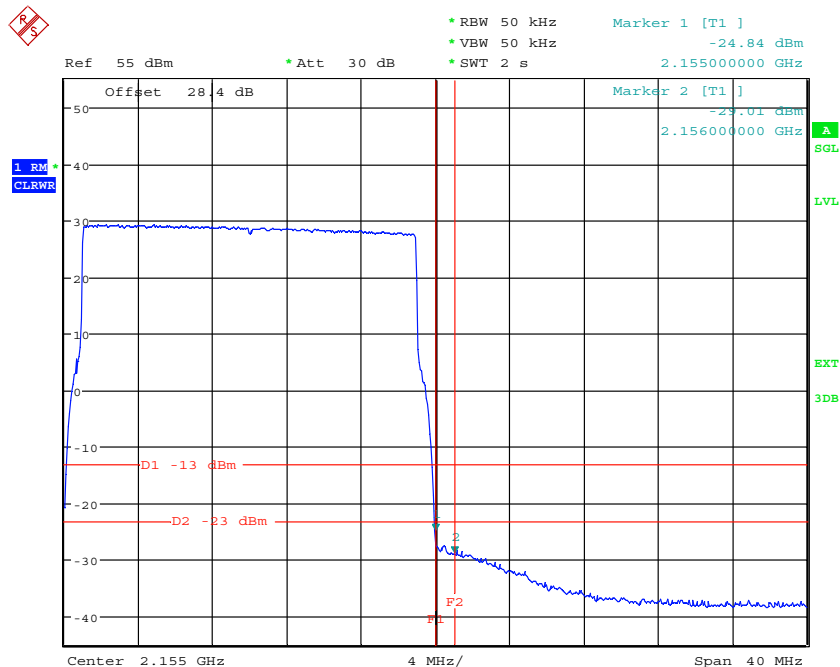
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Config A TX1+TX2:



Date: 30.AUG.2010 15:30:42

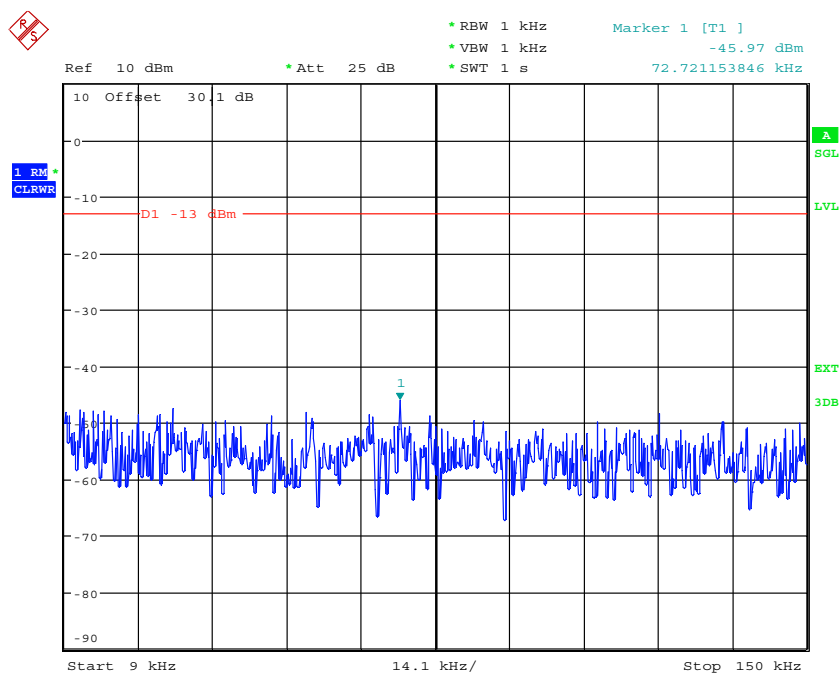
**Figure 7-49: Spurious Emissions (Lower band edge)
– QPSK (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 15:15:03

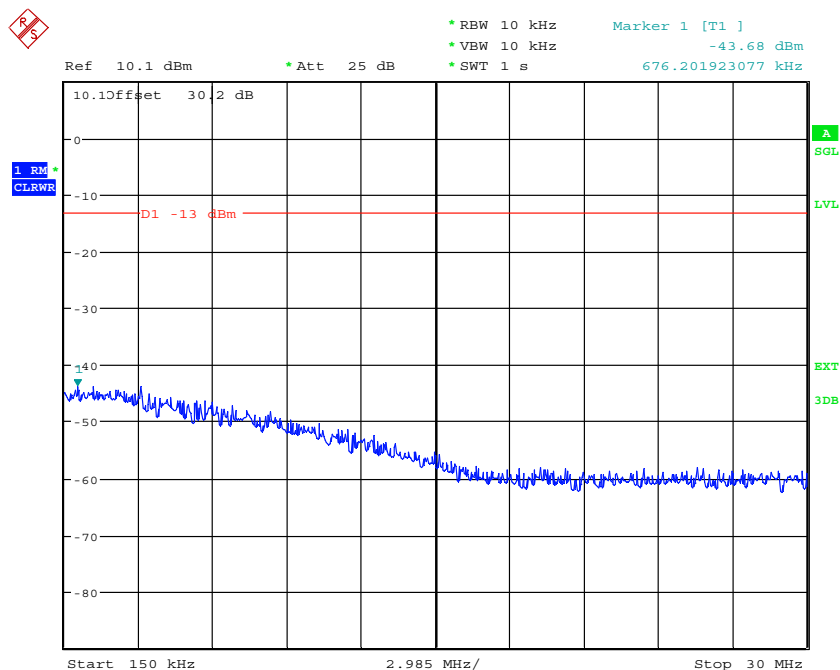
**Figure 7-50: Spurious Emissions (Upper band edge)
– QPSK (2145 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 09:31:46

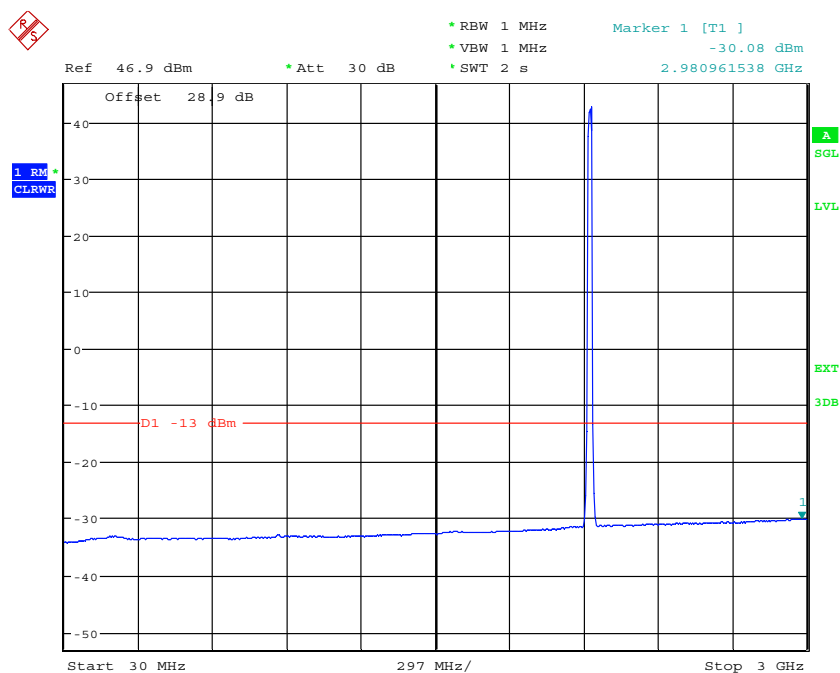
**Figure 7-51: Spurious Emissions (9kHz-150kHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 10:43:03

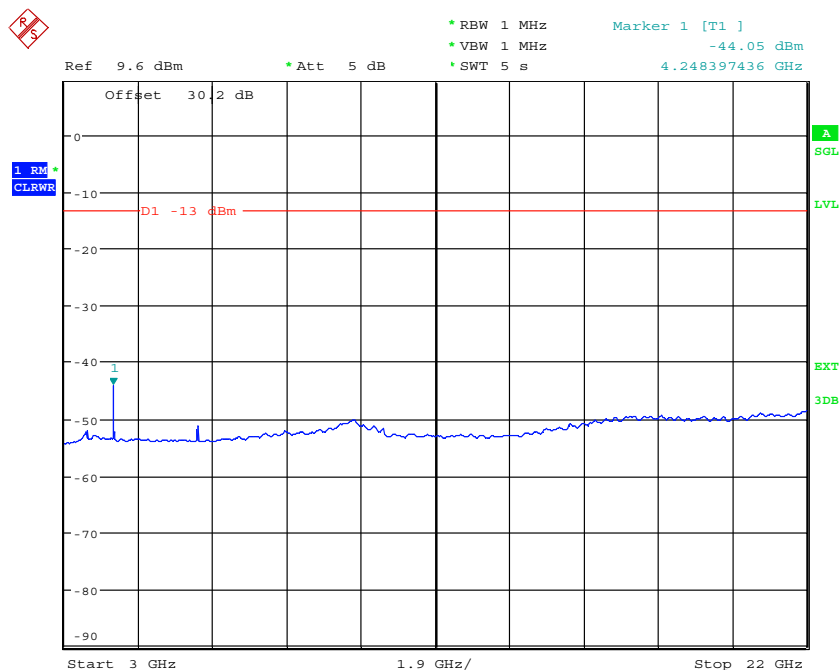
**Figure 7-52: Spurious Emissions (150kHz-30MHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 11:00:59

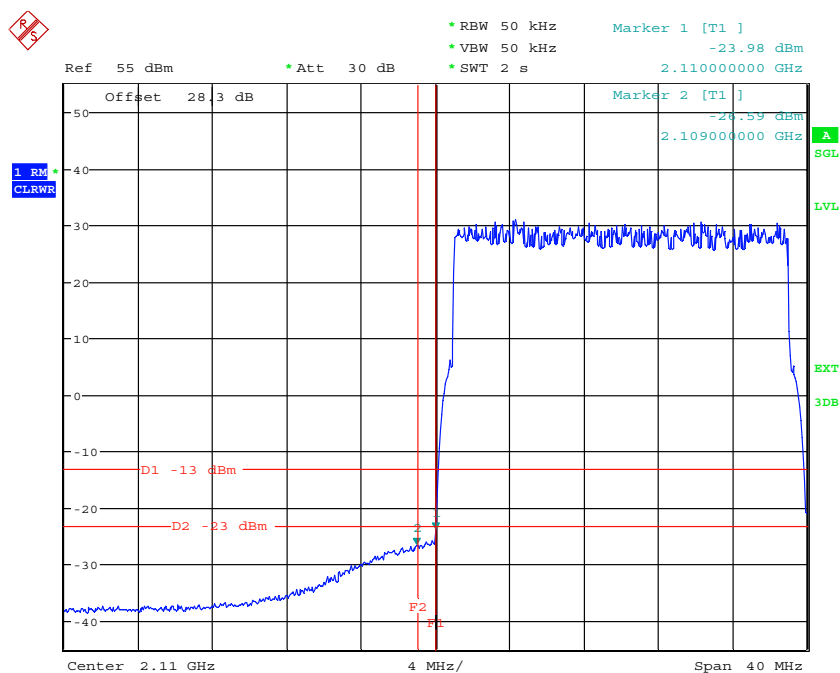
**Figure 7-53: Spurious Emissions (30MHz-3GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 11:35:28

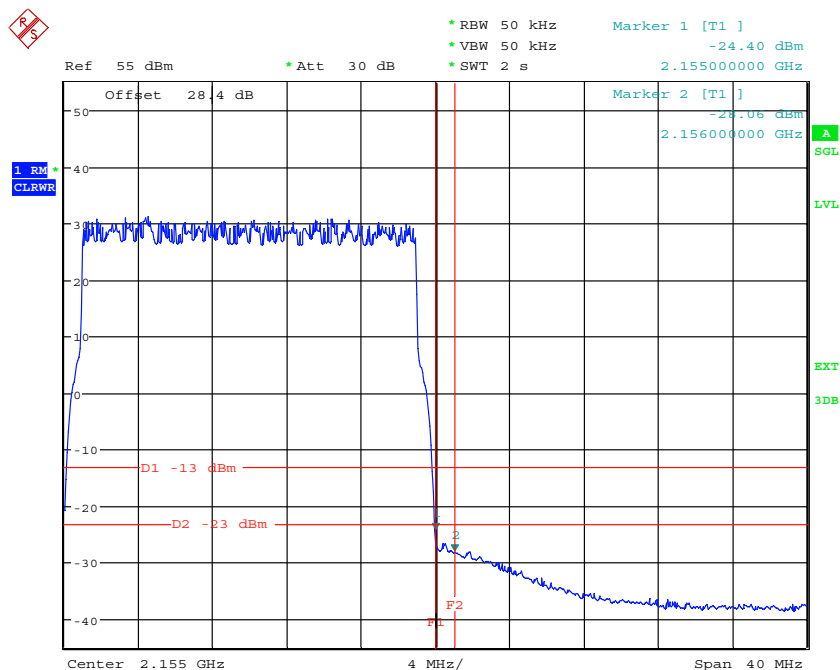
**Figure 7-54: Spurious Emissions (3GHz-22GHz)
– QPSK (2132.5 MHz) (20MHz Channel BW)**

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Date: 30.AUG.2010 15:32:16

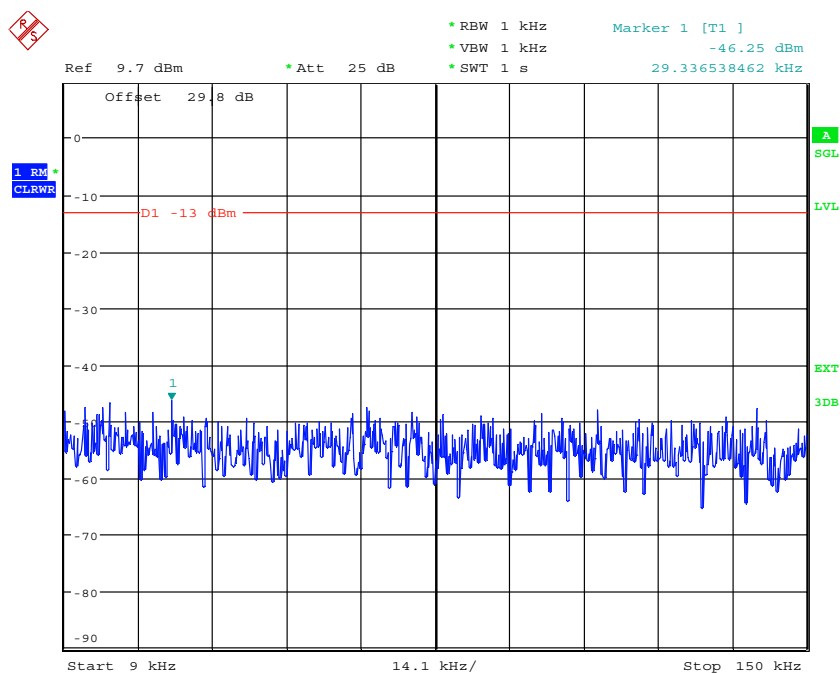
**Figure 7-55: Spurious Emissions (Lower band edge)
– 16QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 15:17:06

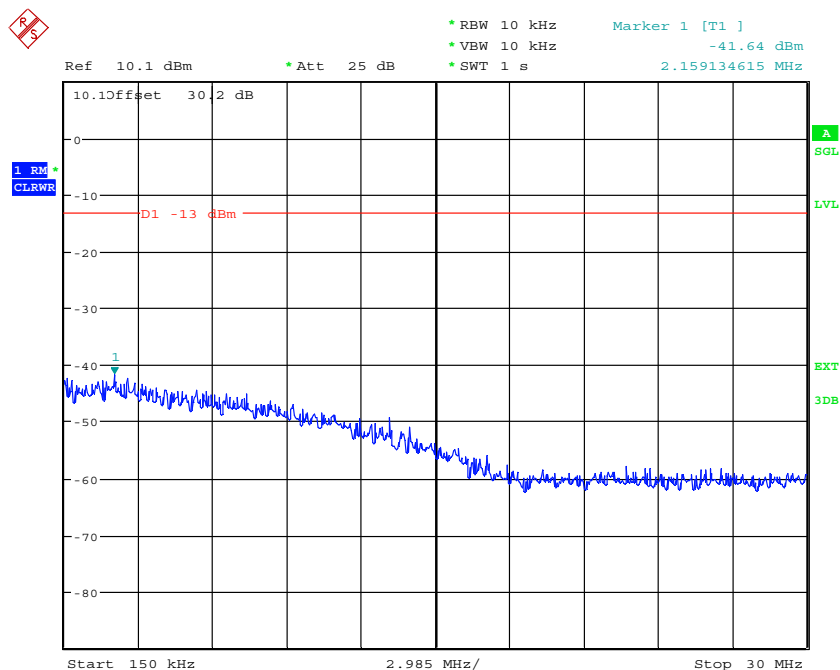
**Figure 7-56: Spurious Emissions (Upper band edge)
– 16QAM (2145 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 09:33:59

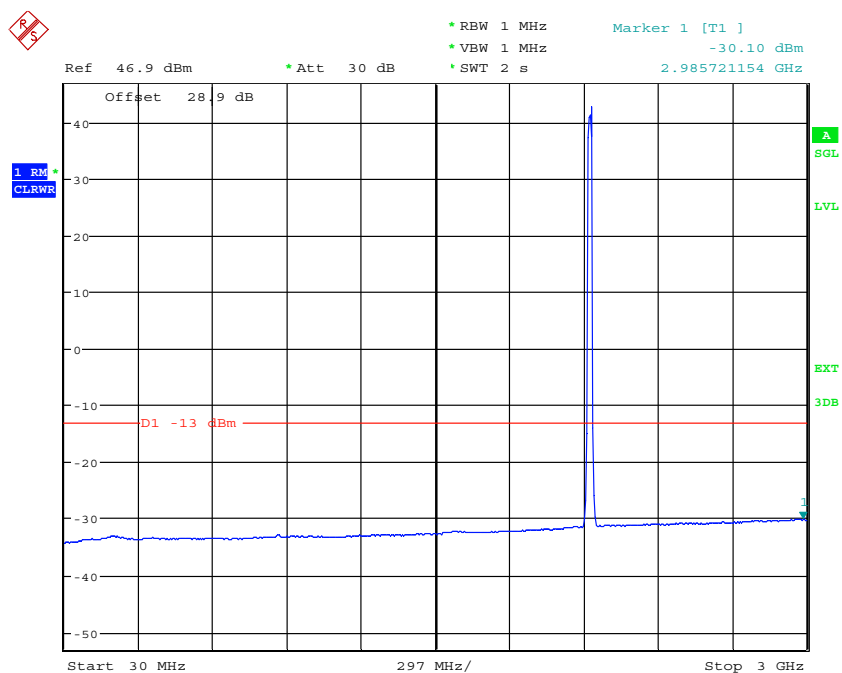
**Figure 7-57: Spurious Emissions (9kHz-150kHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 10:44:07

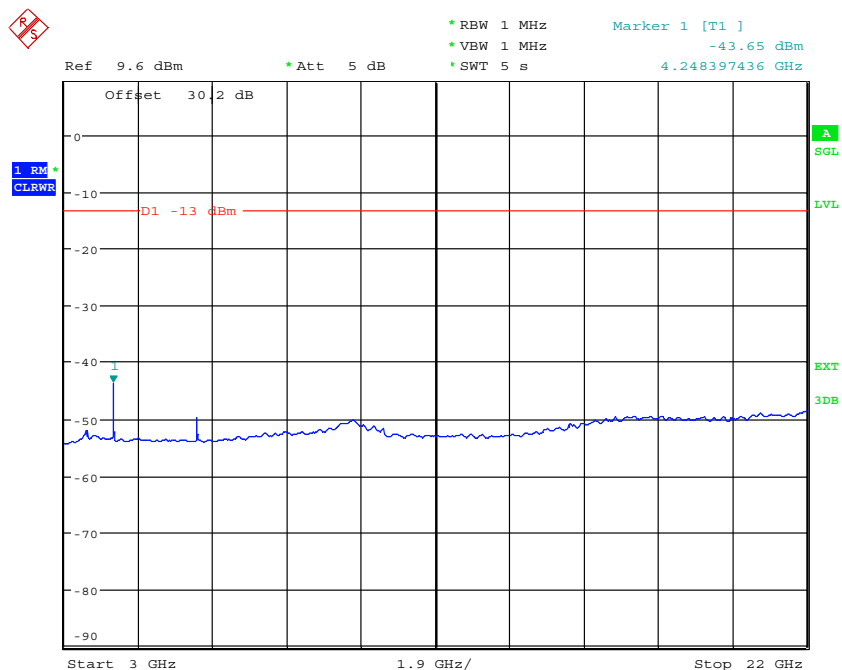
**Figure 7-58: Spurious Emissions (150kHz-30MHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 11:03:36

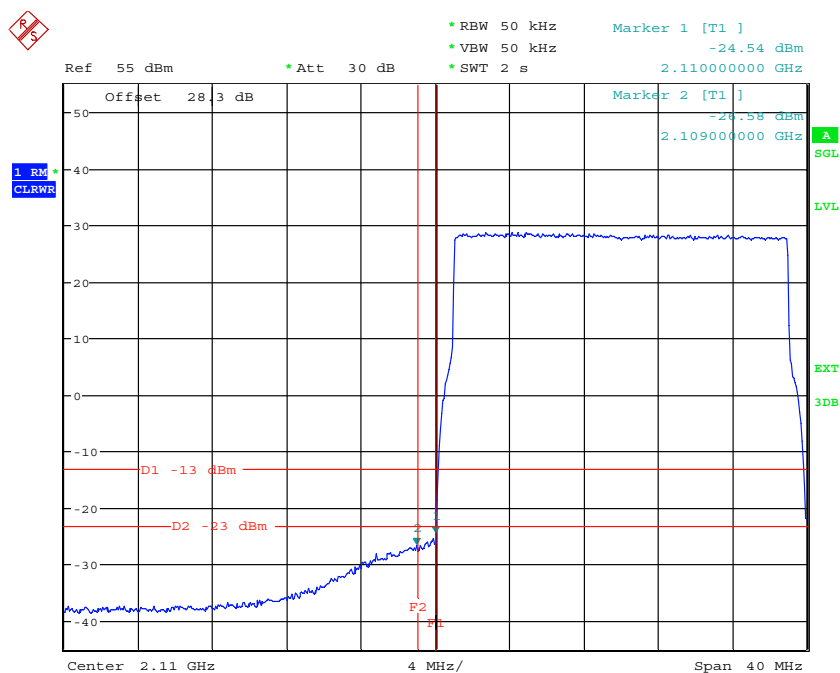
**Figure 7-59: Spurious Emissions (30MHz-3GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 11:38:15

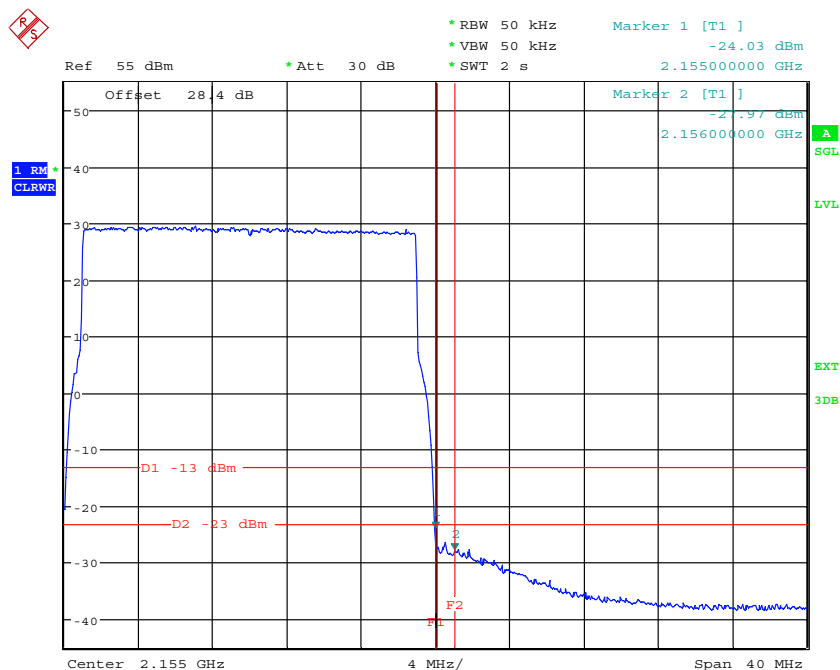
**Figure 7-60: Spurious Emissions (3GHz-22GHz)
– 16QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 30.AUG.2010 15:37:27

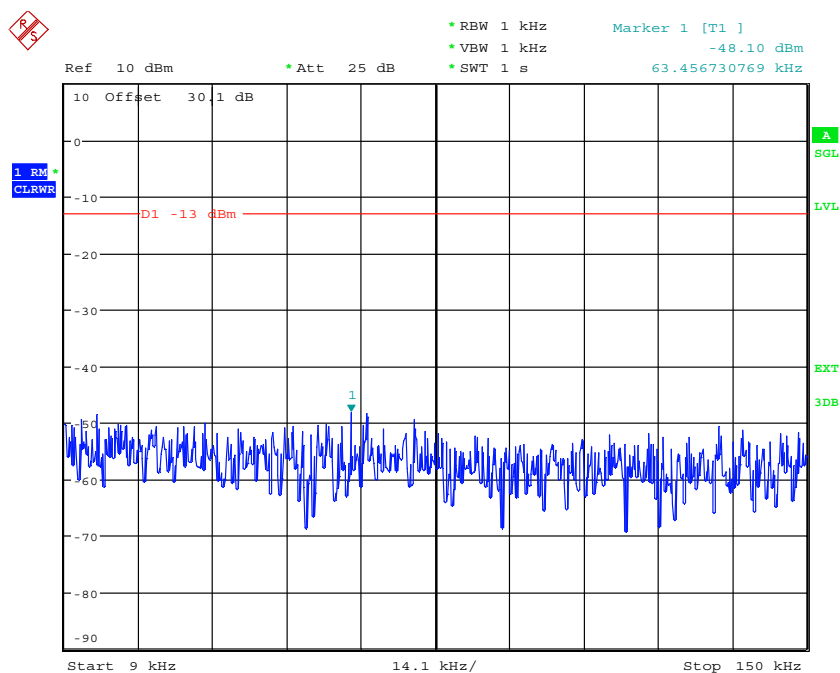
**Figure 7-61: Spurious Emissions (Lower band edge)
– 64QAM (2120 MHz) (20MHz Channel BW)**



Date: 30.AUG.2010 15:18:20

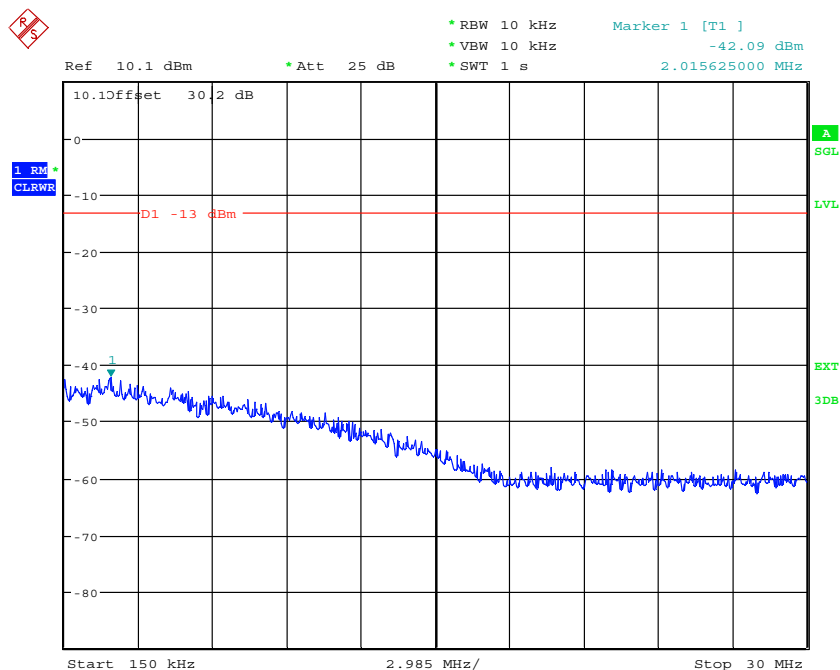
**Figure 7-62: Spurious Emissions (Upper band edge)
– 64QAM (2145 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 09:36:35

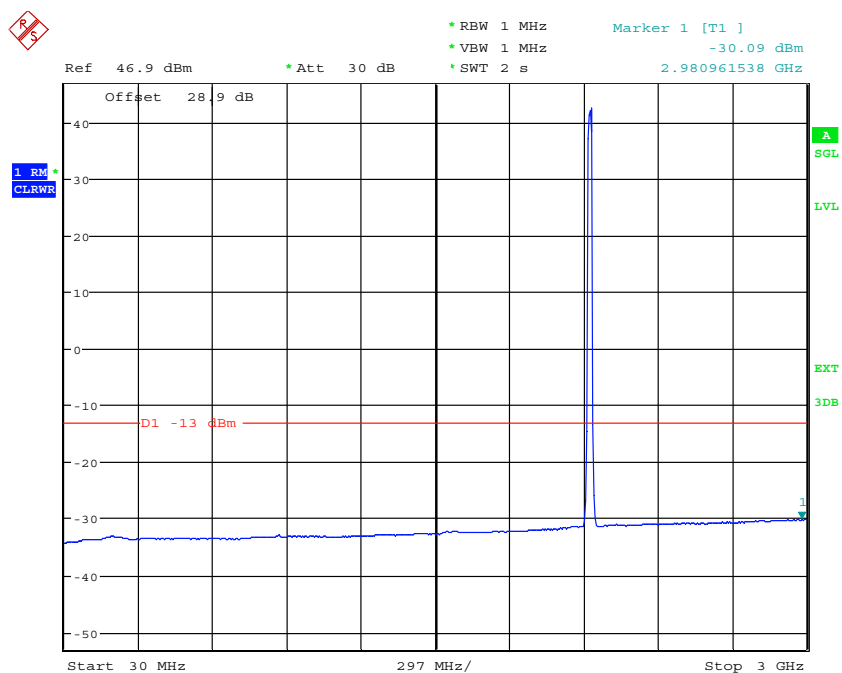
**Figure 7-63: Spurious Emissions (9kHz-150kHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 10:45:31

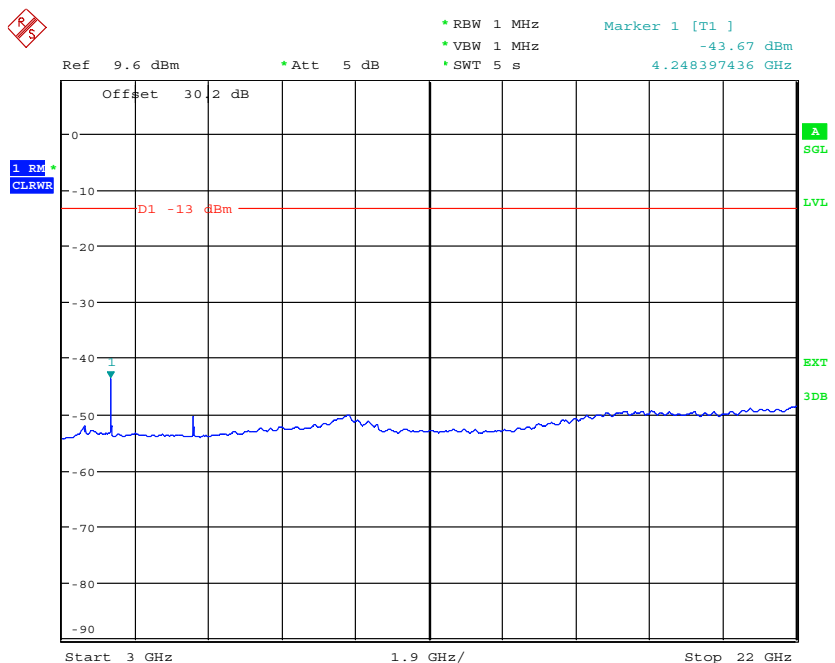
**Figure 7-64: Spurious Emissions (150kHz-30MHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

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Date: 31.AUG.2010 11:05:12

**Figure 7-65: Spurious Emissions (30MHz-3GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**



Date: 31.AUG.2010 11:40:23

**Figure 7-66: Spurious Emissions (3GHz-22GHz)
– 64QAM (2132.5 MHz) (20MHz Channel BW)**

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7.2.4 Test No. 5: Field Strength of Spurious Radiation

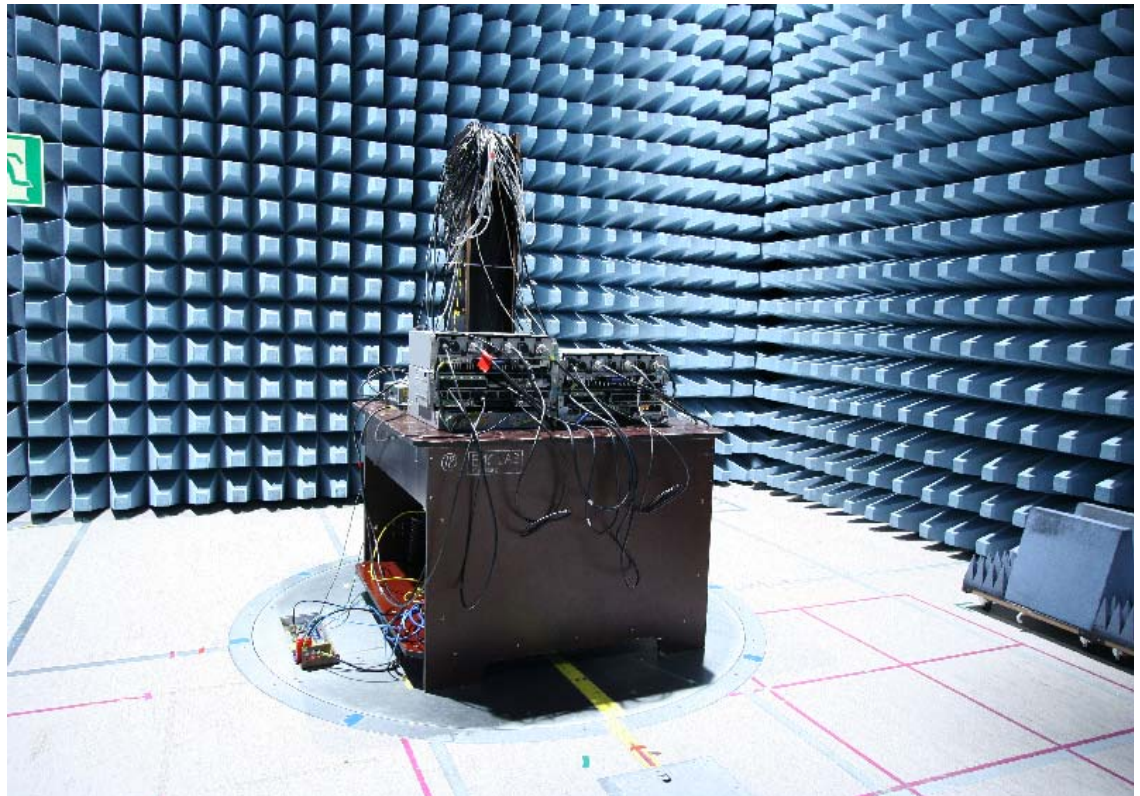


Figure 7-67: Photograph of the anechoic chamber with the EUT

Config A:

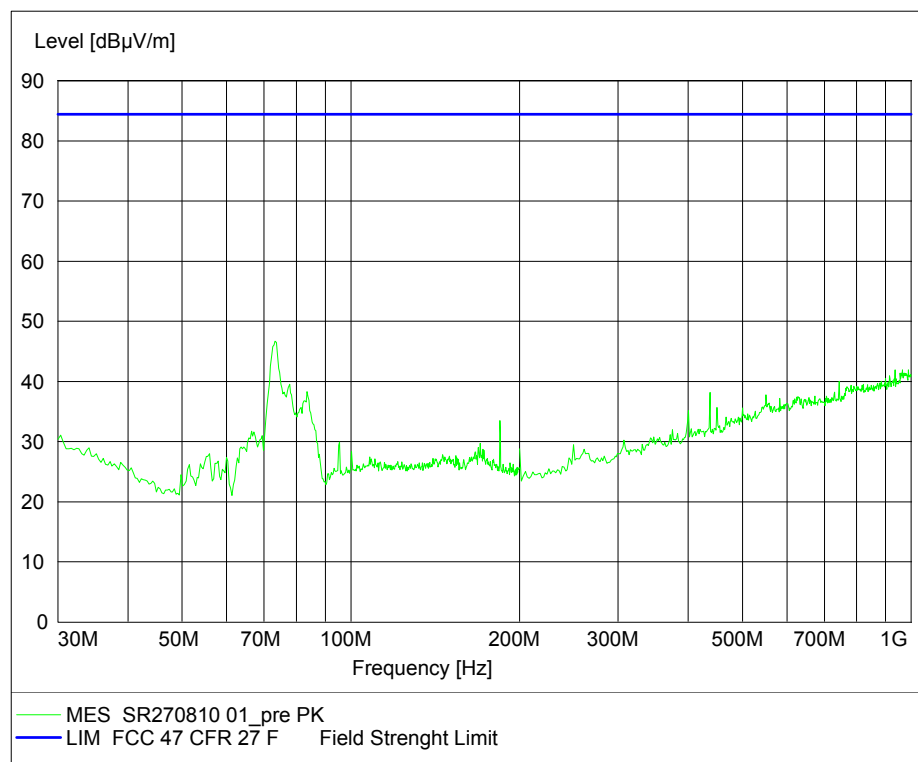


Figure 7-68: Radiated Emission 30 MHz – 1 GHz (20MHz Channel BW)

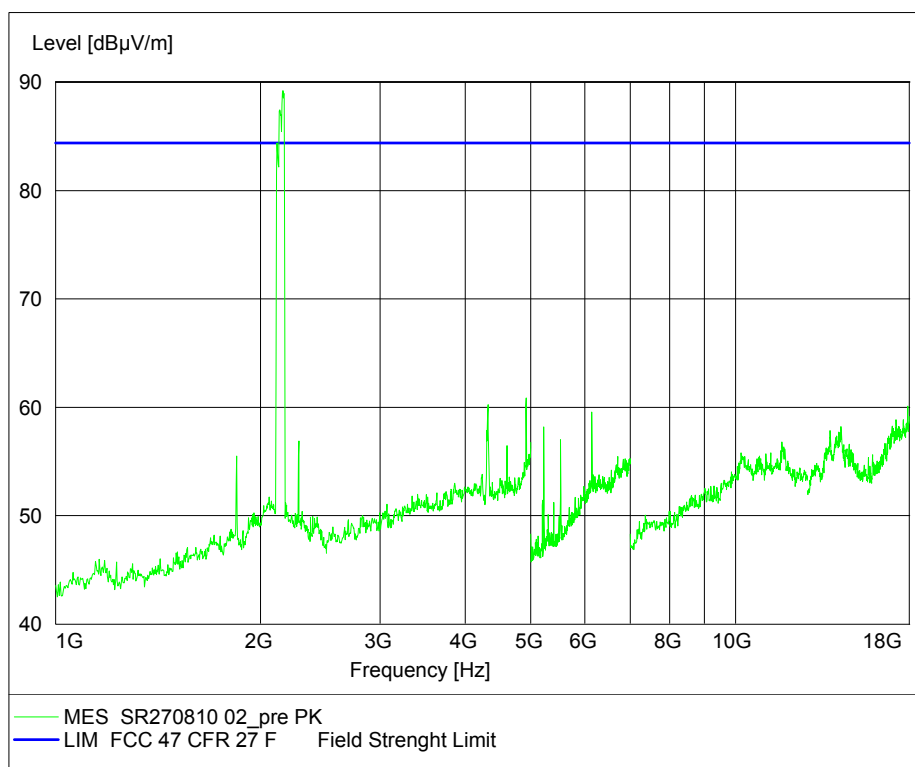


Figure 7-69: Radiated Emission 1 GHz – 18 GHz (20MHz Channel BW)

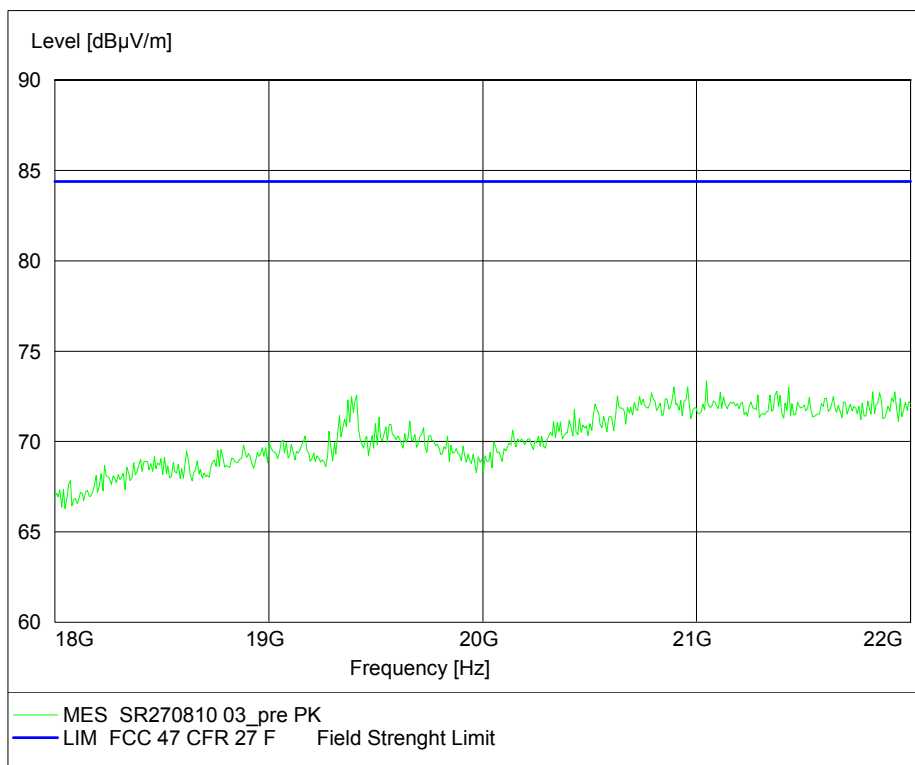


Figure 7-70: Radiated Emission 18 GHz – 22 GHz (20MHz Channel BW)