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RACOM
RADIO DATA NETWORKS

TEST REPORT

Racom_150413TR_FCC version: A

Test of RipEX-200 Radio modem

The tests have been carried out with reference to 47CFR Parts 2 and 90

Measured by: Radek Holý

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1.1 Technical Summary

Applicant:	**Racom s r.o.** **Mírová 1283** **592 31 Nové Město na Moravě**
Manufacturer:	**Racom s.r.o.** **Mírová 1283** **592 31 Nové Město na Moravě** **Czech Republic**
Produced By:	**Racom s.r.o., Czech Republic**
Kind Of Equipment:	**Radio modem**
Type Designation(s):	**RipEX-200**
Code:	**RipEX-215S**
RF Power:	**4-CPFSK 0.1 W to 10 W for 216 – 217 MHz** **4-CPFSK 0.1W to 2W for 217 – 220 MHz** **16-DEQAM 0.5W to 2W** **D8PSK 0.5W to 2W** **π/4-DQPSK 0.5W to 2W**
Alignment Range:	**216 – 217 MHz and 217 – 220 MHz**
Switching Range:	**4 MHz**
Number Of Units:	**1**
Finish Of Test:	**13.4. 2015**
Test made in	**Racom s r.o.** **Mírová 1283** **592 31 Nové Město na Moravě**

1.2 Test Results

Type Designation:	**RipEX-200**
Code:	**RipEX-215S**
Serial No.:	**11844454**
Channel Separation:	**6.25 kHz, 12.5 kHz, 25 kHz, 50 kHz**
FW version	**1.4.4.0**
Transmitter Part:	
CH 1	**216.025 MHz**
CH 2	**219.975 MHz**
Receiver Part:	
CH 1	**216.025 MHz**
CH 2	**219.975 MHz**
Power Supply Range:	**Vnom = 24.0 V DC**
	Vmin = 10.0 V DC
	Vmax = 30.0 V DC
Temperature Range:	**Tnom = Ambient temperature**
	Tmin = -30 °C
	Tmax = +60 °C

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: maximum power (unmodulated carrier - constant envelope modulation)

1.2.1. **RF POWER OUTPUT AT TERMINALS**

RULE PART NUMBER: 2.1046; 90.259 (a)

TEST METHOD: TIA-603-D; 2.2.1

TEST RESULTS:

TEST CONDITIONS		TRANSMITTER POWER [W]		
		CH 1	CH 2	CH 3
Tnom	Vnom	7.73	1.99	- -
Measurement uncertainty		±0.6 dB		

LIMIT: 90.259 (a) In the 217 – 220 MHz band, the maximum transmitter output power is 2 watts.
The maximum antenna height above average terrain (HAAT) is 152m (500 feet).

TEST EQUIPMENT USED: 34; 11; 35

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: maximum power (unmodulated carrier – non constant envelope modulation)

1.2.2. **RF POWER OUTPUT AT TERMINALS**

RULE PART NUMBER: 2.1046; 90.259 (a)

TEST METHOD: TIA-603-D; 2.2.1

TEST RESULTS:

TEST CONDITIONS		TRANSMITTER POWER [W]		
		CH 1	CH 2	CH 3
Tnom	Vnom	2.00	1.99	- -
Measurement uncertainty		±0.6 dB		

LIMIT: 90.259 (a) In the 217 – 220 MHz band, the maximum transmitter output power is 2 watts. The maximum antenna height above average terrain (HAAT) is 152m (500 feet).

TEST EQUIPMENT USED: 34; 11; 35

REMARKS: - -

Ambient temperature: (20±1) °C Relative humidity: (47±10) %

The measurement was carried out at maximum power level

1.2.3. **FREQUENCY STABILITY WITH TEMPERATURE VARIATION**

RULE PART NUMBER: 2.1055; 90.213

TEST METHOD: TIA-603-D; 2.2.2

TEST RESULTS:

TEST CONDITIONS	FREQUENCY ERROR [ppm]		
Temperature (°C)	CH 1	CH 2	CH 3
-30	+0.17	+0.19	- -
-20	+0.11	+0.11	- -
-10	+0.15	+0.14	- -
0	-0.02	-0.02	- -
10	-0.05	-0.06	- -
20	+0.07	+0.09	- -
30	-0.10	-0.08	- -
40	-0.18	-0.17	- -
50	-0.23	-0.22	- -
60	-0.20	-0.20	- -
Maximum frequency error	-0.23/+0.19 ppm (limit 1.0 ppm)		
Measurement uncertainty	±45 Hz		

LIMIT:

Frequency range [MHz]	Fixed and base stations [ppm]	Mobile stations [ppm]	
		Over 2 watts output power	2 watts or less output power
216-220	1.0	- -	1.0

TEST EQUIPMENT USED: 5; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

The measurement was carried out at maximum power level

1.2.4. **FREQUENCY STABILITY WITH PRIMARY VOLTAGE VARIATION**

RULE PART NUMBER: 2.1055; 90.213

TEST METHOD: TIA-603-D; 2.2.2

TEST RESULTS:

TEST CONDITIONS	FREQUENCY ERROR [ppm]		
Voltage (V)	CH 1	CH 2	CH 3
10.0	-0.07	-0.07	- -
15.0	-0.07	-0.07	- -
20.0	-0.07	-0.07	- -
25.0	-0.07	-0.07	- -
30.0	-0.07	-0.07	- -
Maximum frequency error	-0.07 ppm (limit 1.0 ppm)		
Measurement uncertainty	±45 Hz		

LIMIT:

Frequency range [MHz]	Fixed and base stations [ppm]	Mobile stations [ppm]	
		Over 2 watts output power	2 watts or less output power
216-220	1.0	- -	1.0

TEST EQUIPMENT USED: 5; 11; 35

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: 0.1 W

Test signal: 4-CPFSK, 41.67kbps; Random bit sequence

1.2.5. **TRANSMITTER UNWANTED EMISSIONS: CONDUCTED SPURIOUS (0.1 W)**

RULE PART NUMBER: 2.1051, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.13

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
-.-	1000	- -	- -	1000	- -	- -	--	- -
For all frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty			+2.8 dB/-3.3 dB					

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	$43+10\log_{10}$ (P)

$Limit_{(dBc)} = 43+10\log_{10}(P) = 43+10\log_{10}(0.1) = 33dBc$ where P = RF output power in watts

$Limit_{(dBm)} = 10\log_{10}(P_{mW}) - Limit_{(dBc)} = 10\log_{10}(100) - 33 = -13dBm$ where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: 11; 35; 36; 37

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: CH2 - 2.0W and CH1 - 10.0 W

Test signal: 4-CPFSK, 10.42kbps; Random bit sequence

1.2.6. **TRANSMITTER UNWANTED EMISSIONS: CONDUCTED SPURIOUS (2.0; 10 W)**

RULE PART NUMBER: 2.1051, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.13

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
-.-	1000	- -	- -	1000	- -	- -	--	- -
For all frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty			+2.8 dB/-3.3 dB					

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	$43+10\log_{10}$ (P)

$Limit_{(dBc)} = 43+10\log_{10}(P) = 43+10\log_{10}(10) = 53dBc$ where P = RF output power in watts

$Limit_{(dBm)} = 10\log_{10}(P_{mW}) - Limit_{(dBc)} = 10\log_{10}(10000) - 53 = -13dBm$ where P_{mW} = RF output power in mW

$Limit_{(dBc)} = 43+10\log_{10}(P) = 43+10\log_{10}(2) = 46dBc$ where P = RF output power in watts

$Limit_{(dBm)} = 10\log_{10}(P_{mW}) - Limit_{(dBc)} = 10\log_{10}(2000) - 46 = -13dBm$ where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: 11; 35; 36; 37

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: 2.0 W

Test signal: 16-DEQAM 34.72kbps; Random bit sequence

1.2.7. **TRANSMITTER UNWANTED EMISSIONS: CONDUCTED SPURIOUS (2.0 W)**

RULE PART NUMBER: 2.1051, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.13

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
- -	1000	- -	- -	1000	- -	- -	--	- -
For all frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty			+2.8 dB/-3.3 dB					

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	$43+10\log_{10}$ (P)

$Limit_{(dBc)} = 43+10\log_{10}(P) = 43+10\log_{10}(2) = 46dBc$ where P = RF output power in watts

$Limit_{(dBm)} = 10\log_{10}(P_{mW}) - Limit_{(dBc)} = 10\log_{10}(2000) - 46 = -13dBm$ where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: 11; 35; 36; 37

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Rated output power: 0.5 W

Test signal: 16-DEQAM 34.72kbps; Random bit sequence

1.2.8. **TRANSMITTER UNWANTED EMISSIONS: CONDUCTED SPURIOUS (0.5 W)**

RULE PART NUMBER: 2.1051, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.13

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
- -	1000	- -	- -	1000	- -	- -	--	- -
For all frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty			+2.8 dB/-3.3 dB					

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	$43+10\log_{10}$ (P)

$Limit_{(dBc)} = 43+10\log_{10}(P) = 43+10\log_{10}(0.5) = 40dBc$ where P = RF output power in watts

$Limit_{(dBm)} = 10\log_{10}(P_{mW}) - Limit_{(dBc)} = 10\log_{10}(500) - 40 = -13dBm$ where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: 11; 35; 36; 37

REMARKS: - -

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Transmitter operating unmodulated

The measurement was carried out at minimum power level

1.2.9. **TRANSMITTER UNWANTED EMISSIONS: RADIATED SPURIOUS (0.1W)**

RULE PART NUMBER: 2.1053, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.12

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
For all frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty			+4.4 dB/-4.5 dB					

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	43+10log$_{10}$ (P)

$Limit_{(dBc)}$= 43+10log$_{10}$(P)= 43+10log$_{10}$(0.1)= 33dBc where P = RF output power in watts

$Limit_{(dBm)}$= 10log$_{10}$(P_{mW})-$Limit_{(dBc)}$=10log$_{10}$(100)-33= -13dBm where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: - -

REMARKS: Measured in CMI – Laboratory TESTCOM Praha; Test report Ref. No.: 8551-PT-R0066-15

Ambient temperature: (21±1) °C Relative humidity: (47±10) %

Transmitter operating unmodulated

The measurement was carried out at maximum power level

1.2.10. **TRANSMITTER UNWANTED EMISSIONS: RADIATED SPURIOUS (2.0W, 10W)**

RULE PART NUMBER: 2.1053, 90.210 (b,3)

TEST METHOD: TIA-603-D, 2.2.12

TEST RESULTS:

SPURIOUS EMISSIONS								
CH1			CH2			CH3		
Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]	Freq. [MHz]	Bandwidth [kHz]	Level [dBm]
For all other frequencies the spurious emissions were detected at least 20 dB below the limit.								
Measurement uncertainty								

LIMIT:

CHANNEL BANDWIDTH	6.25; 12.5; 25.0; 50.0 kHz
FREQUENCY RANGE	f_o > 250%Bw
SPURIOUS EMISSION LEVEL [dBc]	43+10log$_{10}$ (P)

$Limit_{(dBc)}$= 43+10log$_{10}$(P)= 43+10log$_{10}$(10)= 53dBc where P = RF output power in watts

$Limit_{(dBm)}$= 10log$_{10}$(P_{mW})-$Limit_{(dBc)}$=10log$_{10}$(500)-53= -13dBm where P_{mW} = RF output power in mW

$Limit_{(dBc)}$= 43+10log$_{10}$(P)= 43+10log$_{10}$(2)= 46dBc where P = RF output power in watts

$Limit_{(dBm)}$= 10log$_{10}$(P_{mW})-$Limit_{(dBc)}$=10log$_{10}$(2000)-46= -13dBm where P_{mW} = RF output power in mW

TEST EQUIPMENT USED: - -

REMARKS: Measured in CMI – Laboratory TESTCOM Praha; Test report Ref. No.: 8551-PT-R0066-15

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

The measurement at maximum power level

1.2.17. **TRANSMITTER OCCUPIED BANDWIDTH**

RULE PART NUMBER: 2.201, 2.202, 2.1049 (H), 2.1041

TEST METHOD: 971168 D01 Power Meas License Digital Systems v02r02, 4.2

TEST RESULTS:

Channel Spacing	6.25 kHz	12.5 kHz	25.0 kHz	50.0 kHz	6.25 kHz	6.25 kHz
Emission Type	3K60F1D	8K60F1D	16K0F1D	28K0F1D	5K00D1D	5K00G1D
Modulation	4-CPFSK	4-CPFSK	4-CPFSK	4-CPFSK	16-DEQAM	D8PSK
Data Rate	5.21 kbit/s	10.42 kbit/s	20.83 kbit/s	41.67 kbit/s	17.36 kbit/s	13.02 kbit/s
Measured Peak Deviation	1.52 kHz	3.90 kHz	7.10 kHz	11.8 kHz	---	---
Measured 99% Occupied BW	3.55 kHz	8.53 kHz	15.9 kHz	28.0 kHz	4.89 kHz	4.92 kHz

Channel Spacing	6.25 kHz	12.5 kHz	12.5 kHz	12.5 kHz	25.0 kHz	25.0 kHz
Emission Type	5K00G1D	10K0D1D	10K0G1D	10K0G1D	16K0D1D	16K0G1D
Modulation	π/4-DQPSK	16-DEQAM	D8PSK	π/4-DQPSK	16-DEQAM	D8PSK
Data Rate	8.68 kbit/s	34.72 kbit/s	26.04 kbit/s	17.36 kbit/s	55.56 kbit/s	41.67 kbit/s
Measured Peak Deviation	---	---	---	---	---	---
Measured 99% Occupied BW	4.91 kHz	9.80 kHz	9.85 kHz	9.85 kHz	15.9 kHz	15.9 kHz

Channel Spacing	25.0 kHz	50.0 kHz	50.0 kHz	50.0 kHz
Emission Type	16K0G1D	40K0D1D	40K0G1D	40K0G1D
Modulation	π/4-DQPSK	16-DEQAM	D8PSK	π/4-DQPSK
Data Rate	27.78 kbit/s	138.89 kbit/s	104.17 kbit/s	69.44 kbit/s
Measured Peak Deviation	---	---	---	---
Measured 99% Occupied BW	15.9 kHz	39.6 kHz	39.7 kHz	39.6 kHz

TEST EQUIPMENT USED: 5; 11; 35; 7

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: Maximum power

Test signal: 4-CPFSK 5.21kbps; Random bit sequence

1.2.18. **TRANSMITTER OCCUPIED BANDWIDTH (4-CPFSK, MAX. POWER, 6.25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 1; CH2 - GRAPH 17)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: 16-DEQAM 17.36kbps; Random bit sequence

1.2.19. **TRANSMITTER OCCUPIED BANDWIDTH (16-DEQAM, 2.0 W, 6.25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 2; CH2 - GRAPH 18)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: D8PSK 13.02kbps; Random bit sequence

1.2.20. **TRANSMITTER OCCUPIED BANDWIDTH (D8PSK, 2.0 W, 6.25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 3; CH2 - GRAPH 19)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: π/4-DQPSK 8.68kbps; Random bit sequence

1.2.21. **TRANSMITTER OCCUPIED BANDWIDTH (π/4-DQPSK, 2.0 W, 6.25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 4; CH2 - GRAPH 20)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: Maximum power

Test signal: 4-CPFSK 10.42kbps; Random bit sequence

1.2.22. **TRANSMITTER OCCUPIED BANDWIDTH (4-CPFSK, MAX. POWER, 12.5 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 5**;** CH2 - GRAPH 21)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: 16-DEQAM 34.72kbps; Random bit sequence

1.2.23. **TRANSMITTER OCCUPIED BANDWIDTH (16-DEQAM, 2.0 W, 12.5 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4,CH1 - GRAPH 6; CH2 - GRAPH 22)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: D8PSK 26.04kbps; Random bit sequence

1.2.24. **TRANSMITTER OCCUPIED BANDWIDTH (D8PSK, 2.0 W, 12.5 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 7; CH2 - GRAPH 23)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: π/4-DQPSK 17.36kbps; Random bit sequence

1.2.25. **TRANSMITTER OCCUPIED BANDWIDTH (π/4-DQPSK, 2.0 W, 12.5 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 8; CH2 -GRAPH 24)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: Maximun power

Test signal: 4-CPFSK 20.83kbps; Random bit sequence

1.2.22. **TRANSMITTER OCCUPIED BANDWIDTH (4-CPFSK, MAX. POWER, 25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 9**;** CH2 - GRAPH 25)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: 16-DEQAM 55.56kbps; Random bit sequence

1.2.23. **TRANSMITTER OCCUPIED BANDWIDTH (16-DEQAM, 2.0 W, 25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 10; CH2 - GRAPH 26)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: D8PSK 41.67kbps; Random bit sequence

1.2.24. **TRANSMITTER OCCUPIED BANDWIDTH (D8PSK, 2.0 W, 25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 11; CH2 - GRAPH 27)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: π/4-DQPSK 27.78kbps; Random bit sequence

1.2.25. **TRANSMITTER OCCUPIED BANDWIDTH (π/4-DQPSK, 2.0 W, 25 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 12; CH2 - GRAPH 28)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: Maximum power

Test signal: 4-CPFSK 41.67kbps; Random bit sequence

1.2.22. **TRANSMITTER OCCUPIED BANDWIDTH (4-CPFSK, MAX. POWER, 50 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 13; CH2 - GRAPH 29)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: 16-DEQAM 138,89kbps; Random bit sequence

1.2.23. **TRANSMITTER OCCUPIED BANDWIDTH (16-DEQAM, 2.0 W, 50 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 14; CH2 - GRAPH 30)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: D8PSK 104.17kbps; Random bit sequence

1.2.24. **TRANSMITTER OCCUPIED BANDWIDTH (D8PSK, 2.0 W, 50 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 15; CH2 - GRAPH 31)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

Ambient temperature: (22±1) °C Relative humidity: (53±10) %

Rated output power: 2.0 W

Test signal: π/4-DQPSK 69.44kbps; Random bit sequence

1.2.25. **TRANSMITTER OCCUPIED BANDWIDTH (π/4-DQPSK, 2.0 W, 50 kHz)**

RULE PART NUMBER: 2.1049, 90.210

TEST METHOD: TIA-603-D; 3.2.11

TEST RESULTS: Meets minimum standards (See chapter 4, CH1 - GRAPH 16; CH2 - GRAPH 32)

LIMIT:

	Attenuator [dB]	Frequency offset [kHz]
Mask B	0.0 dB	f_o < 50%Bw
	25.0 dB	50%Bw < f_o < 100%Bw
	35.0 dB	100%Bw < f_o < 250%Bw
	43+10*$\log_{10}$(P)	250%Bw < f_o
	Note: P is output power in W	

TEST EQUIPMENT USED: 36; 11; 35

REMARKS: - -

1.5 Summary of Test Results

P = Complied with the requirements of the specification for this test

U = The results were within measurement uncertainties

F = Not complied with the requirements of the specification for this test

N/A = Not applicable

Unit No. 1

2. Test Equipment

No.	Id. No.	Test equipment	Type	Manufacturer	Serial No.	Calibration valid
1	10258	Signal Analyzer	FSIQ3	R&S	830790/0001	23.9.2015
2	10237	Spectrum Analyzer	FSP3	R&S	100767	
3	10219/1	Spectrum Analyzer	FSP30	R&S	100015	
4	900000574	Attenuator 30dB/100W	PE7021-30	Pasternack	- -	
5	10276	Spectrum Analyzer	E4446A	Agilent	MY48250231	20.03.2016
6	10172	Stabilock 4040	SI 4040	Wavetek	2025057	
7	10173	Stabilock 4040	SI 4040	Schlumbeger	1825233	27.04.2015
8	900000611	Attenuator 30dB/40W	ATE30dB/40W	APEX	051103	
9	900000349	Attenuator 30dB/40W	ATE30dB/40W	APEX	051106	
10	900000613	Attenuator 30dB/40W	ATE30dB/40W	APEX	051102	
11	900000681	Attenuator 30dB/10W	PE7015-30	Pasternack	- -	
12	900000575	Step Attenuator	PE7033-2	Pasternack	900000575	
13	- -	Heating Chamber	- -	- -	- -	
14	10161	Freezing Box	- -	- -	- -	
15	699385	Digital Multimeter	M-3850	Metex	EB 127 259	
16	- -	4-Port Junction Pad	- -	- -	- -	
17	10291	Mixed Signal Oscilloscope	MSO 2024	Tektronix	- -	
18	10293	Dig. Phosphor Oscilloscope	DPO 2024	Tektronix	- -	
19	10203	Digital Oscilloscope	TDS2014	Tektronix	C032141	
20	10240	Signal Generator	IFR 2023B	IRF	202306/936	
21	10046	Signal Generator	8640B	HP	2250A20733	
22	10238	Signal Generator	E4438	Agilent	MY45091475	
23	10219/2	Signal Generator	SML03	R&S	100560	
24	- -	Power Splitter	- -	- -	- -	
25	- -	Termination 50 Ohm/1 W	- -	- -	- -	
26	- -	Termination 50 Ohm/1 W	- -	- -	- -	
27	- -	Termination 50 Ohm/1 W	- -	- -	- -	
28	- -	Isolating Transformer	- -	- -	- -	
29	- -	Interval Counter	- -	- -	- -	
30	900000609	Power Supply	Statron	Statron	0308023	
31	900000457	Power Supply	Statron	Statron	0510006	
32	- -	High Pass Filter (400MHz)	- -	- -	- -	
33	- -	High Pass Filter (160MHz)	- -	- -	- -	
34	10377	Wideband Power Sensor	NRP-Z85	R&S	101183	18.10.2016
35	900001390	Power Supply	SDP2603	Manson	G291101202	
36	10375	Singal & spectrum Analyzer	FSW	R&S	100608	25.04.2015
37	- -	Signal Generator	SMB 100A	R&S	176216	12.02.2016

3. Additional Information

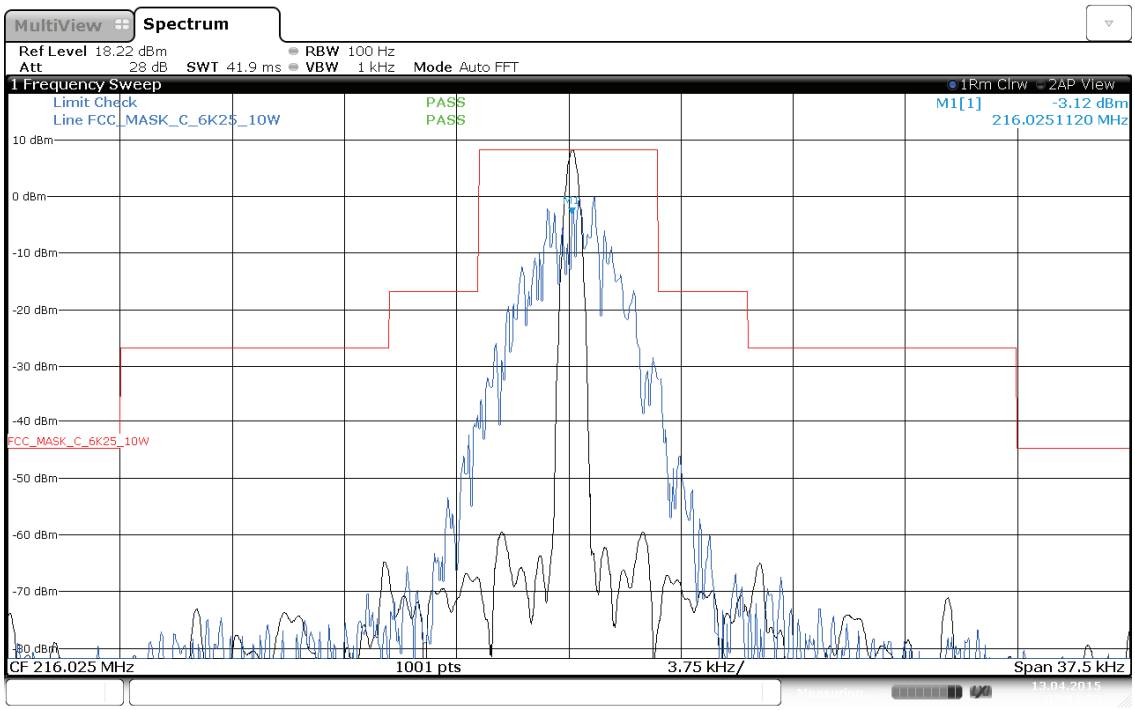
4. Graphs

List of graphs:

4.1 Graphs – 216.025 MHz

GRAPH 1: Spectrum for Emission 6.25 kHz 4-CPFSK

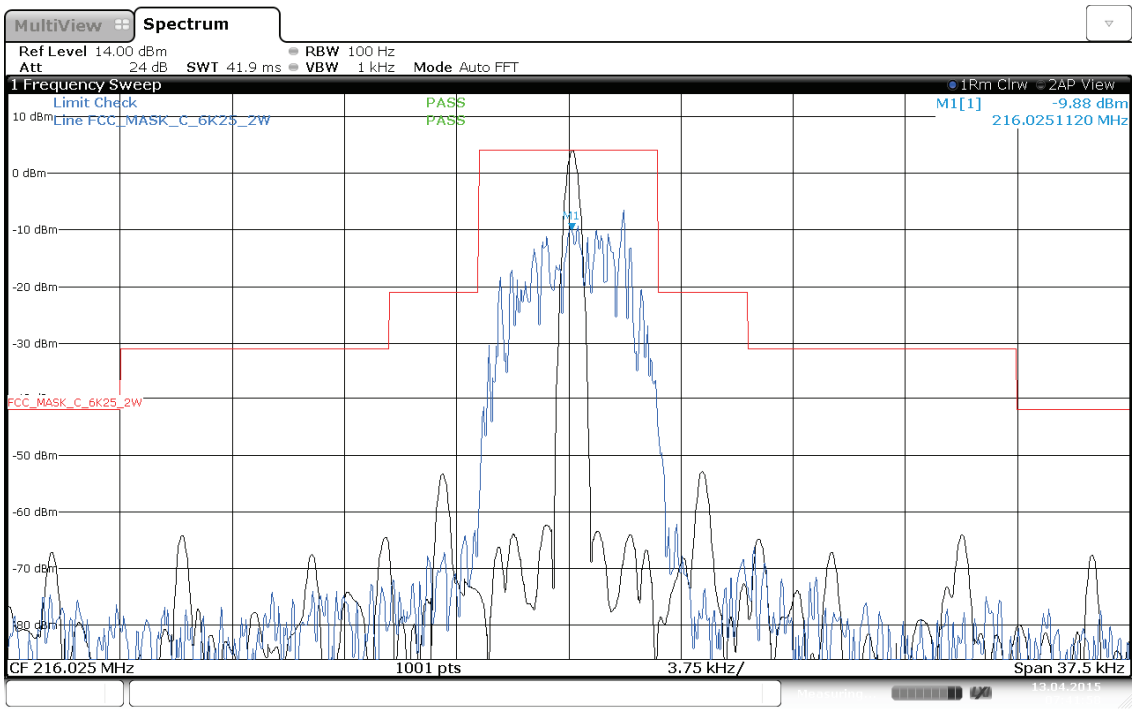
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:44:33

GRAPH 2: Spectrum for Emission 6.25 kHz 16-DEQAM

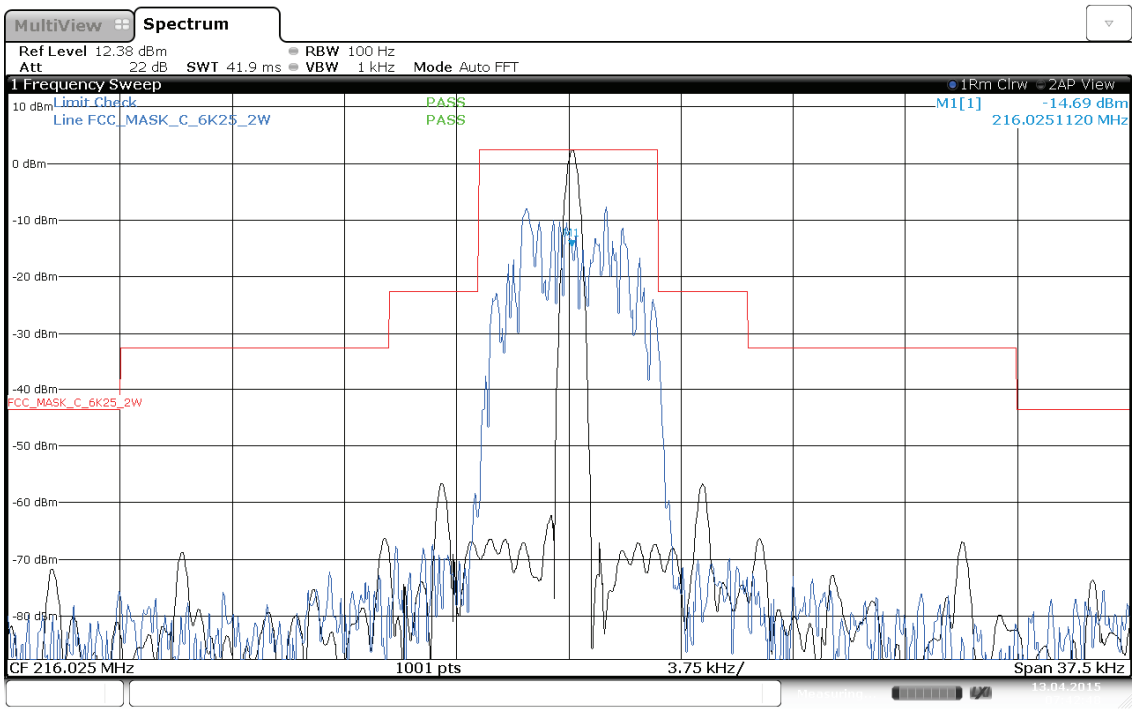
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:41:58

GRAPH 3: Spectrum for Emission 6.25 kHz D8PSK

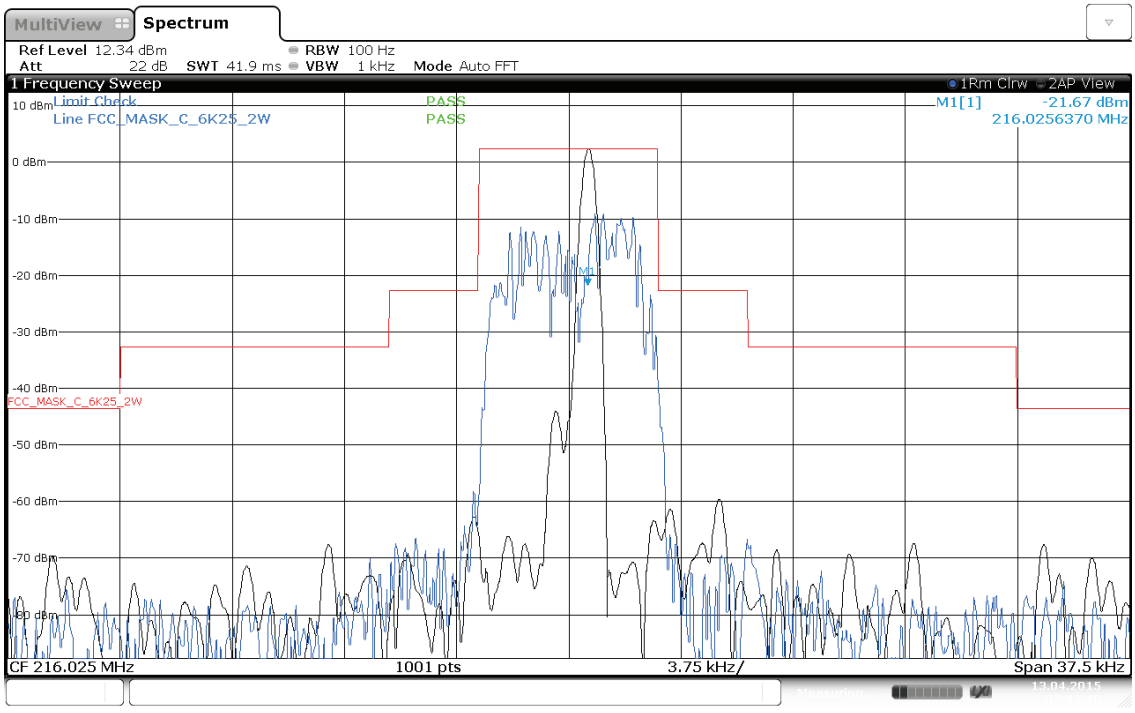
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:42:49

GRAPH 4: Spectrum for Emission 6.25 kHz π/4-DQPSK

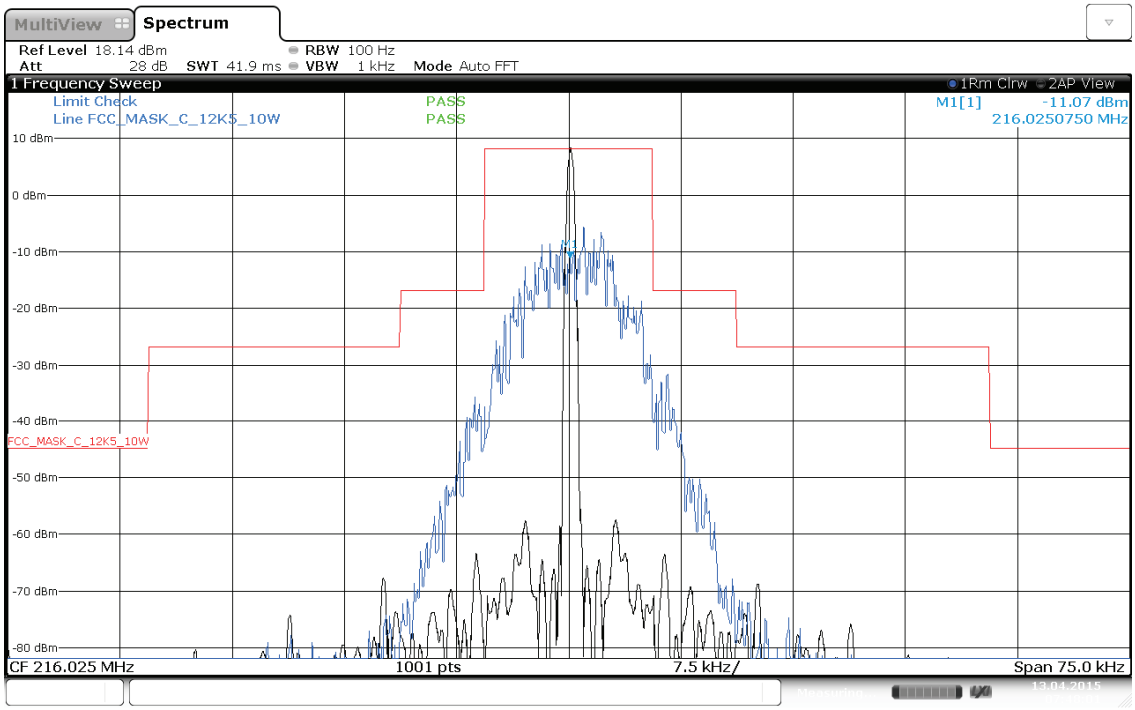
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:43:40

GRAPH 5: Spectrum for Emission 12.5 kHz 4-CPFSK

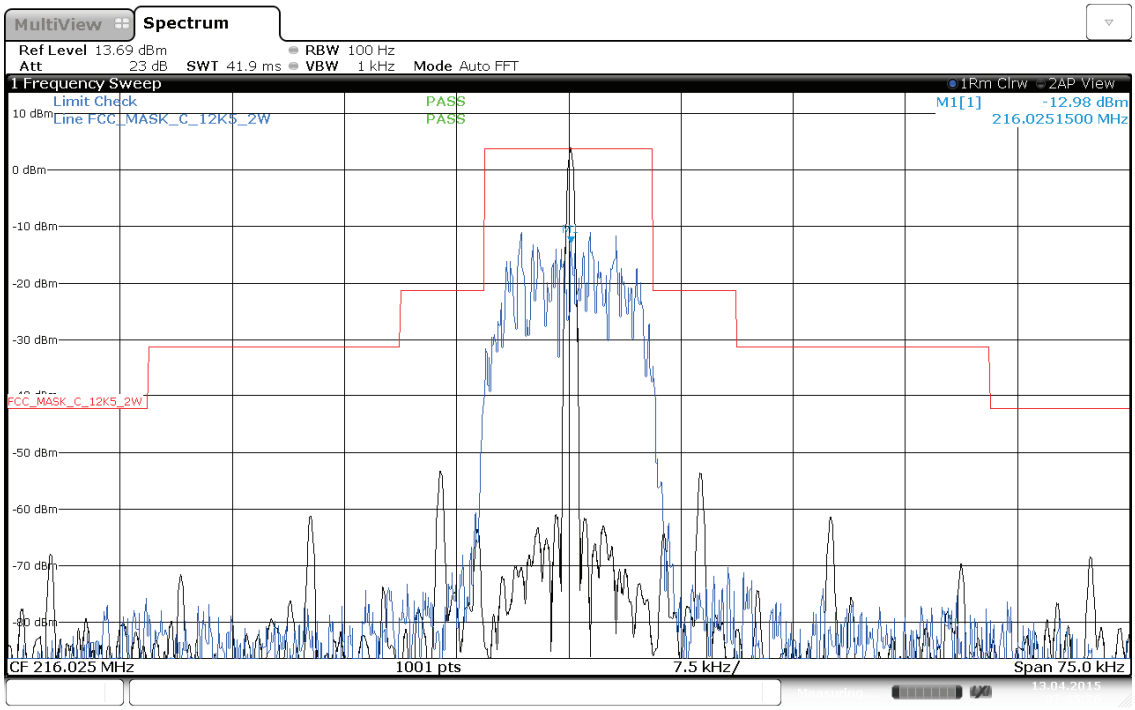
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:48:01

GRAPH 6: Spectrum for Emission 12.5 kHz 16-DEQAM

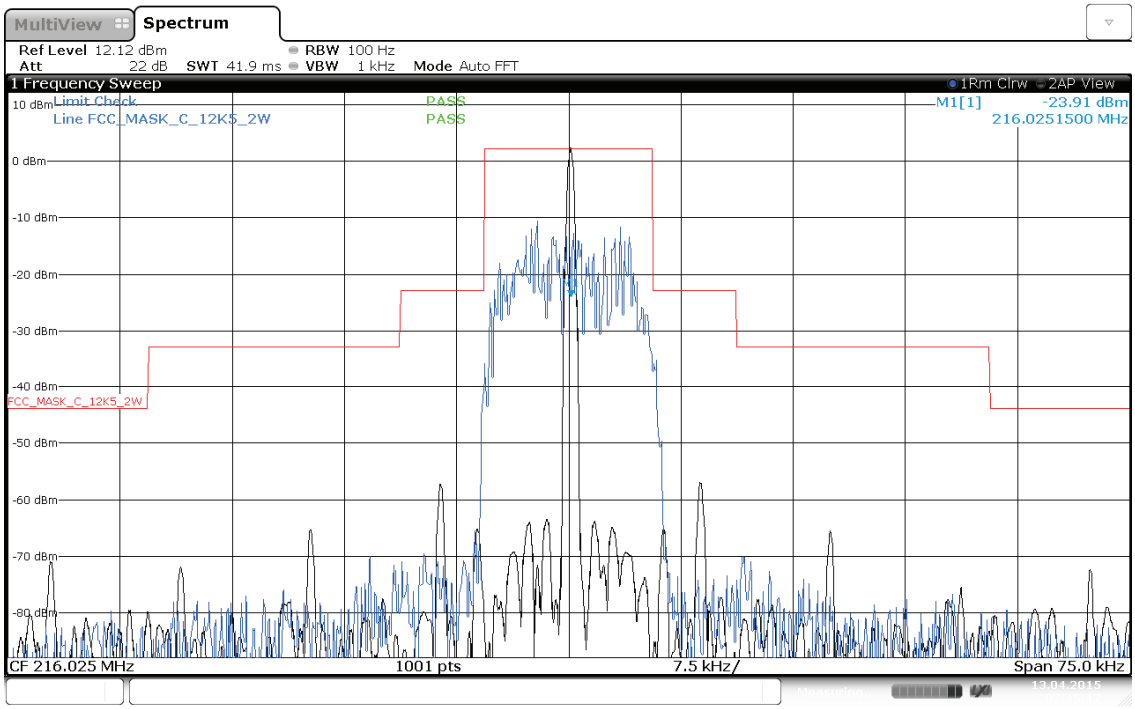
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:45:25

GRAPH 7: Spectrum for Emission 12.5 kHz D8PSK

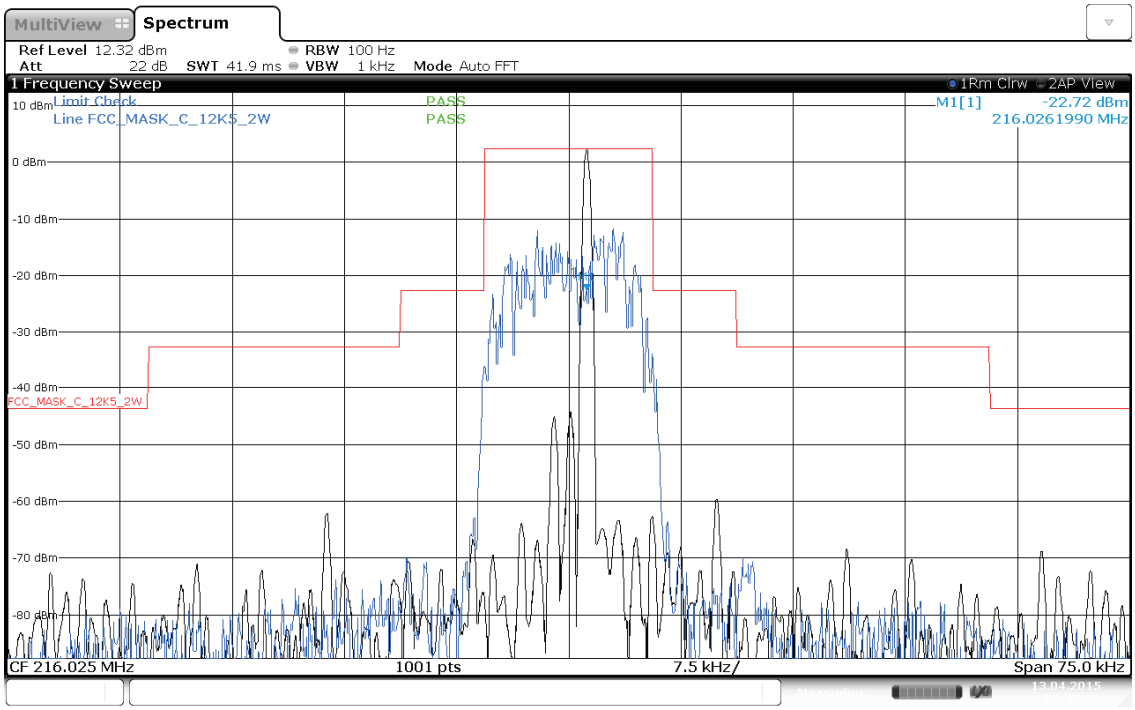
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:46:17

GRAPH 8: Spectrum for Emission 12.5 kHz π/4-DQPSK

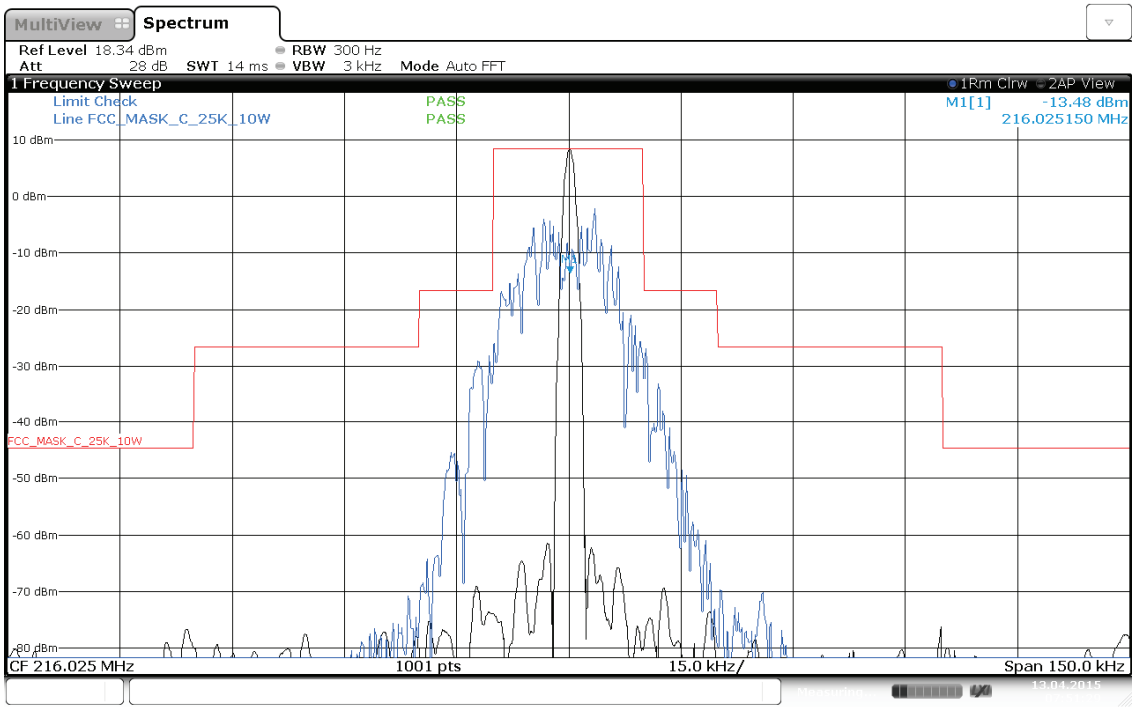
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:47:09

GRAPH 9: Spectrum for Emission 25 kHz 4-CPFSK

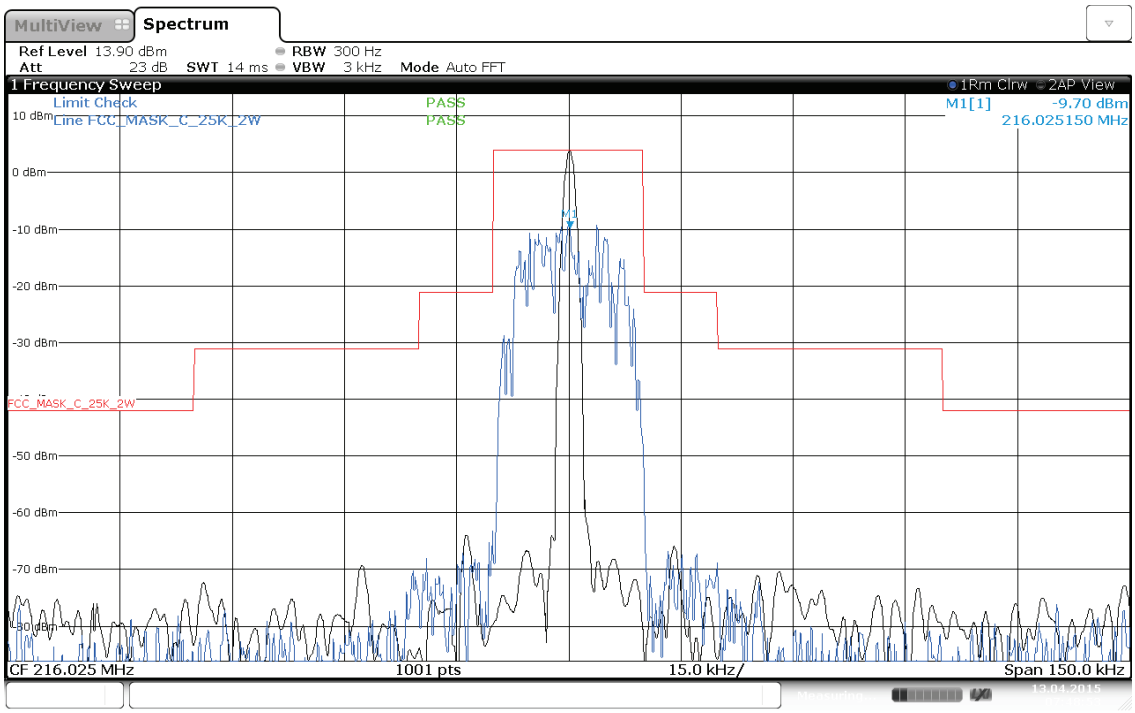
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:51:29

GRAPH 10: Spectrum for Emission 25 kHz 16-DEQAM

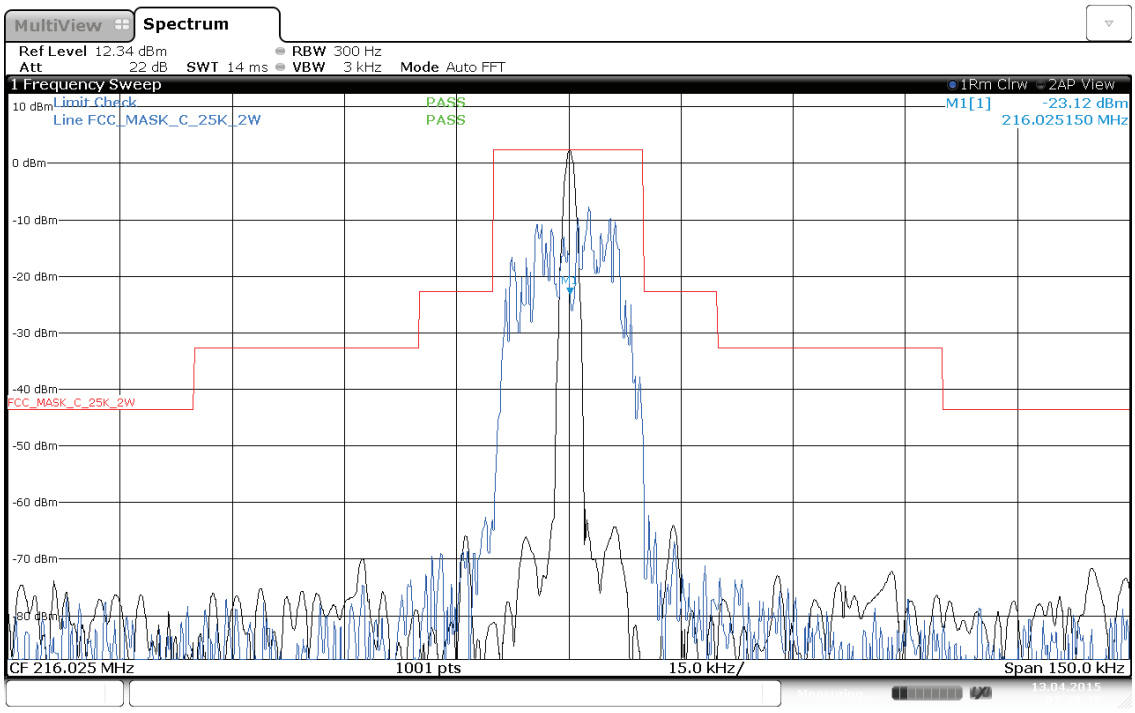
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:48:54

GRAPH 11: Spectrum for Emission 25 kHz D8PSK

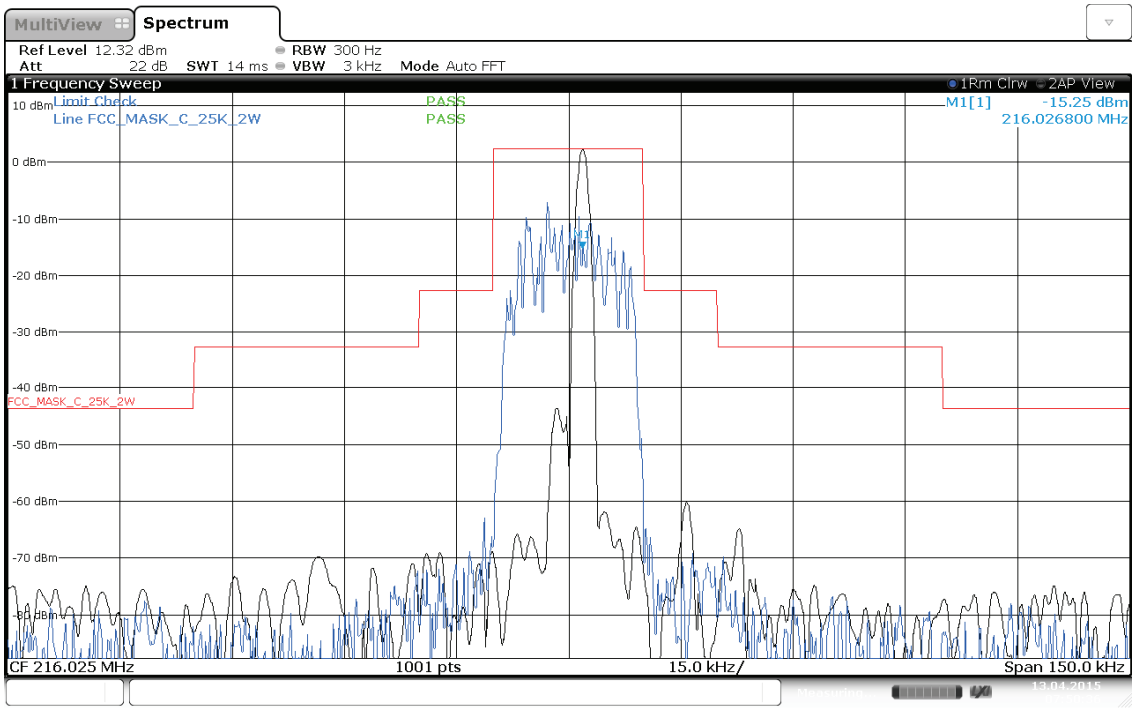
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:49:45

GRAPH 12: Spectrum for Emission 25 kHz π/4-DQPSK

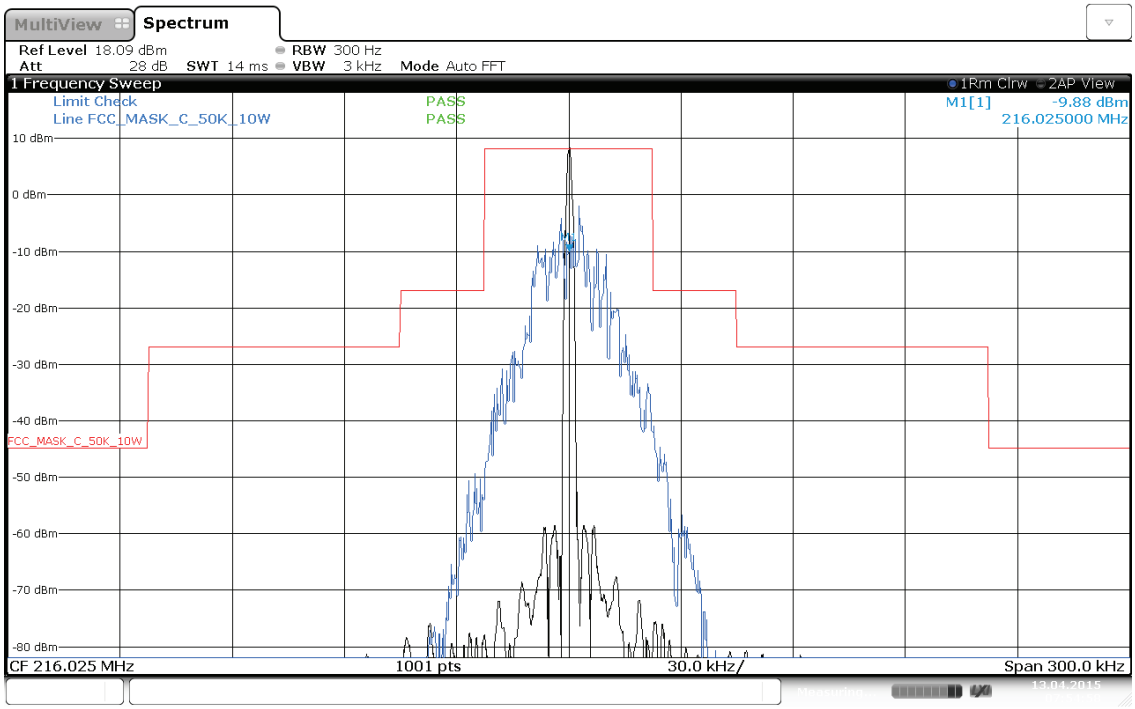
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:50:36

GRAPH 13: Spectrum for Emission 50 kHz 4-CPFSK

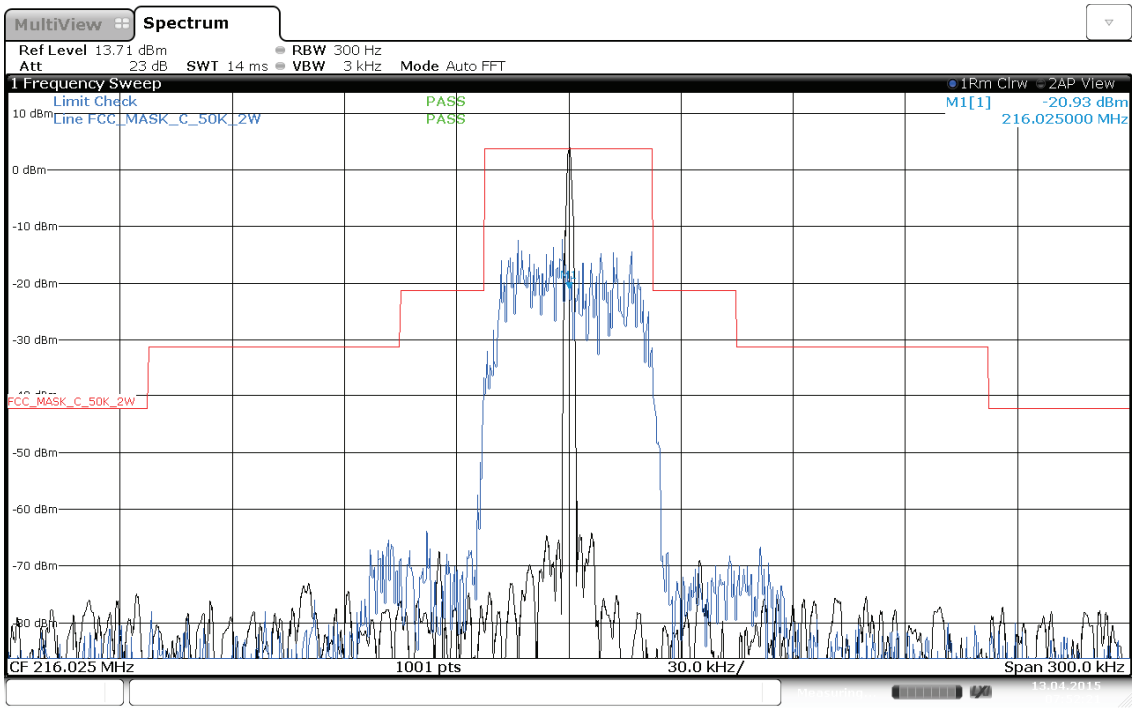
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:54:57

GRAPH 14: Spectrum for Emission 50 kHz 16-DEQAM

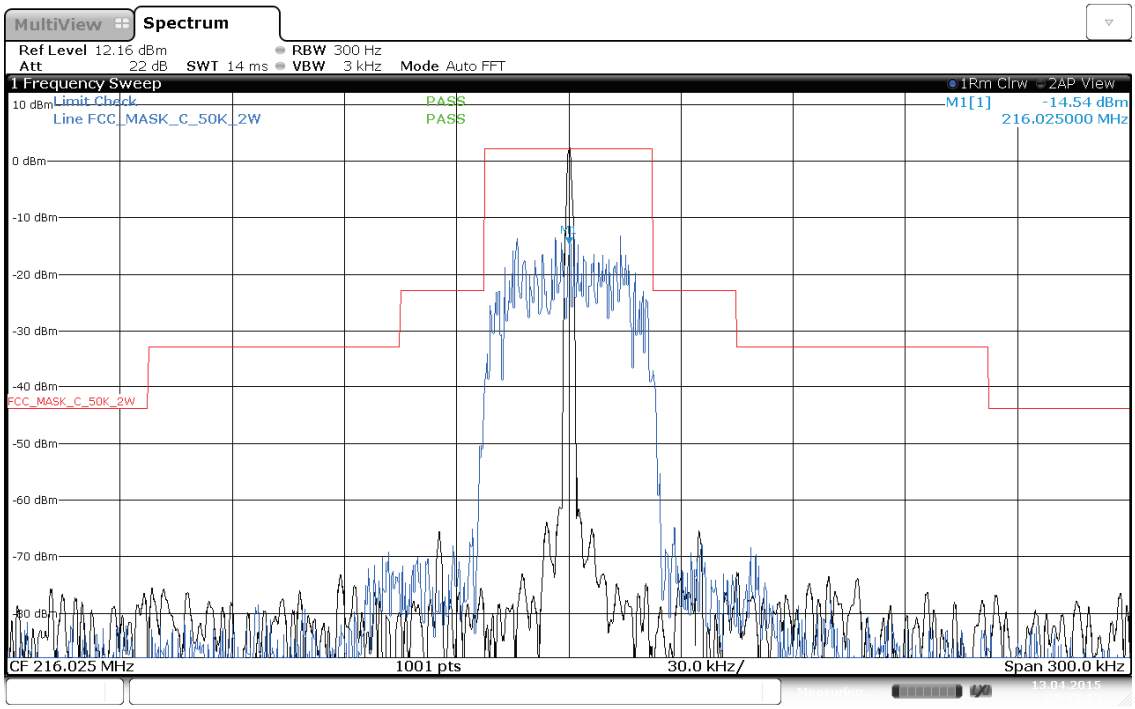
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:52:21

GRAPH 15: Spectrum for Emission 50 kHz D8PSK

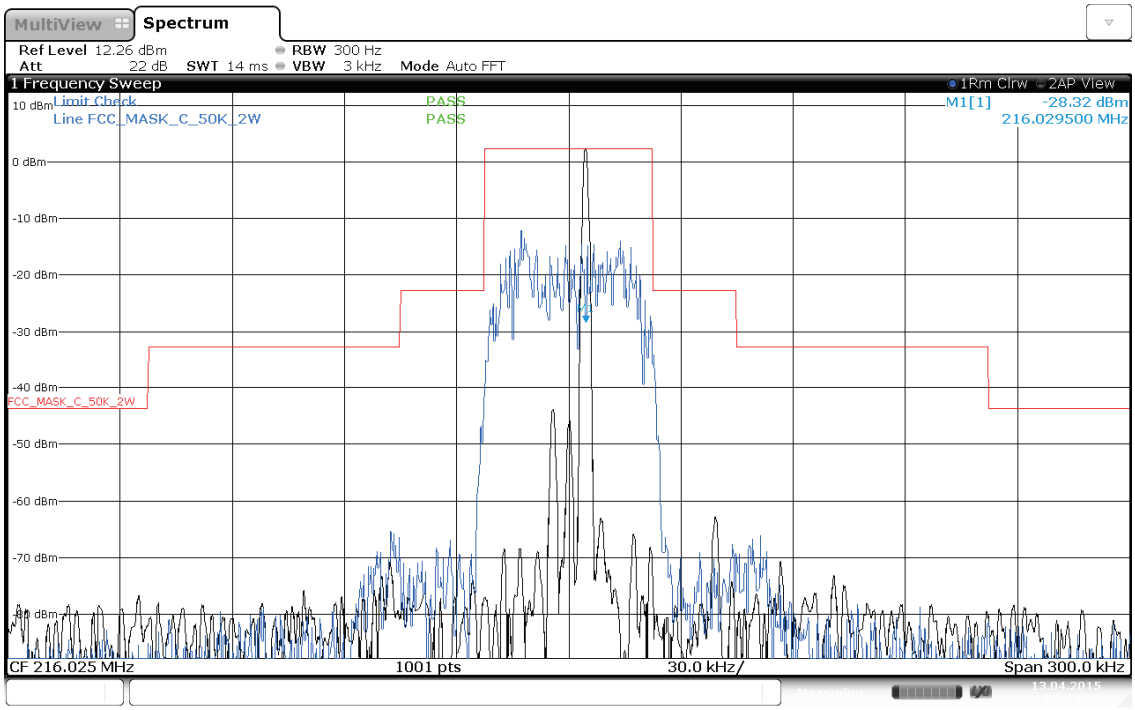
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 07:53:13

GRAPH 16: Spectrum for Emission 50 kHz π/4-DQPSK

The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.

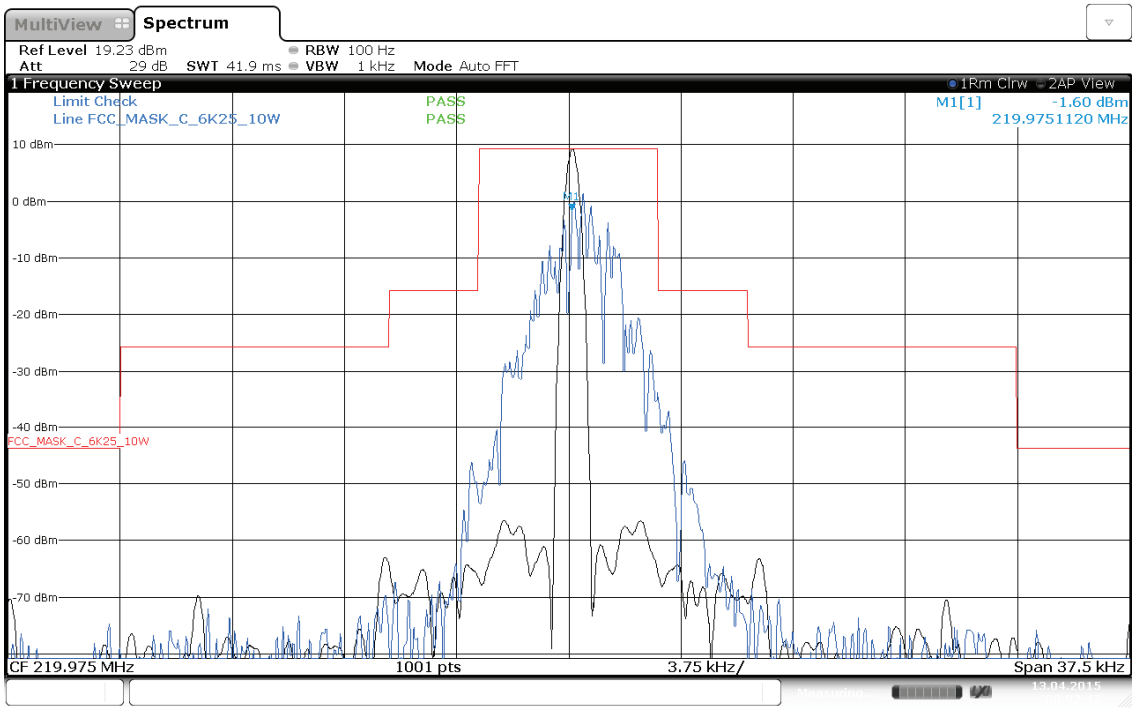


Date: 13.APR.2015 07:54:04

4.3 Graphs – 219.975 MHz

GRAPH 17: Spectrum for Emission 6.25 kHz 4-CPFSK

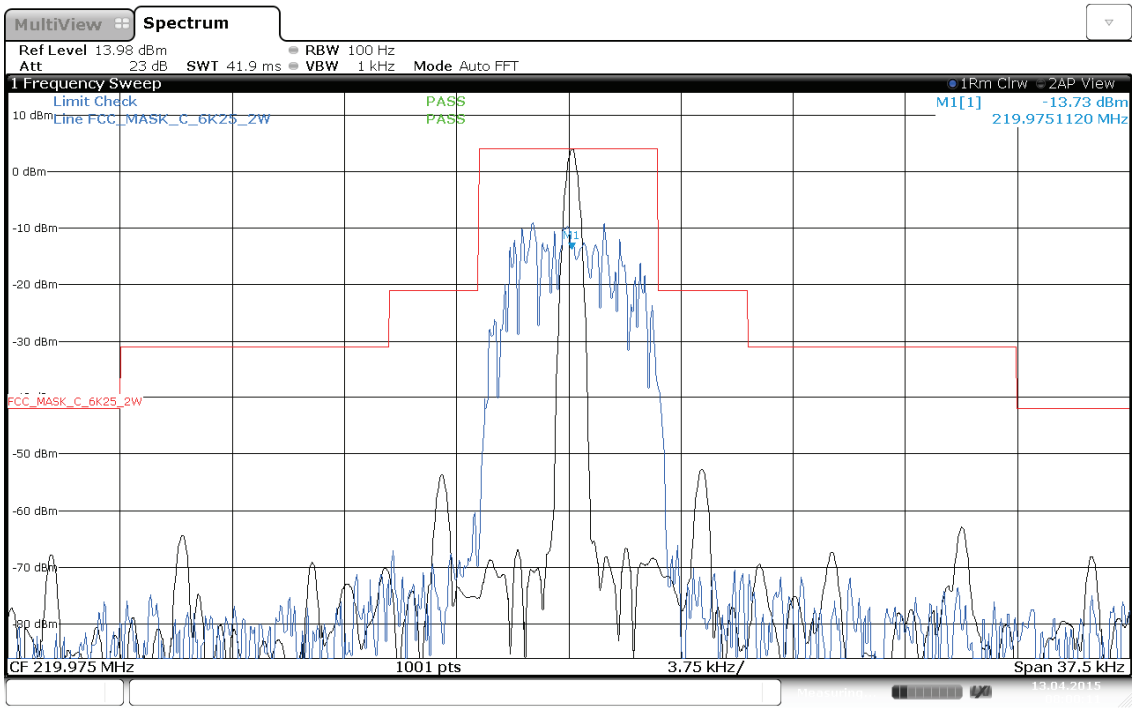
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:02:47

GRAPH 18: Spectrum for Emission 6.25 kHz 16-DEQAM

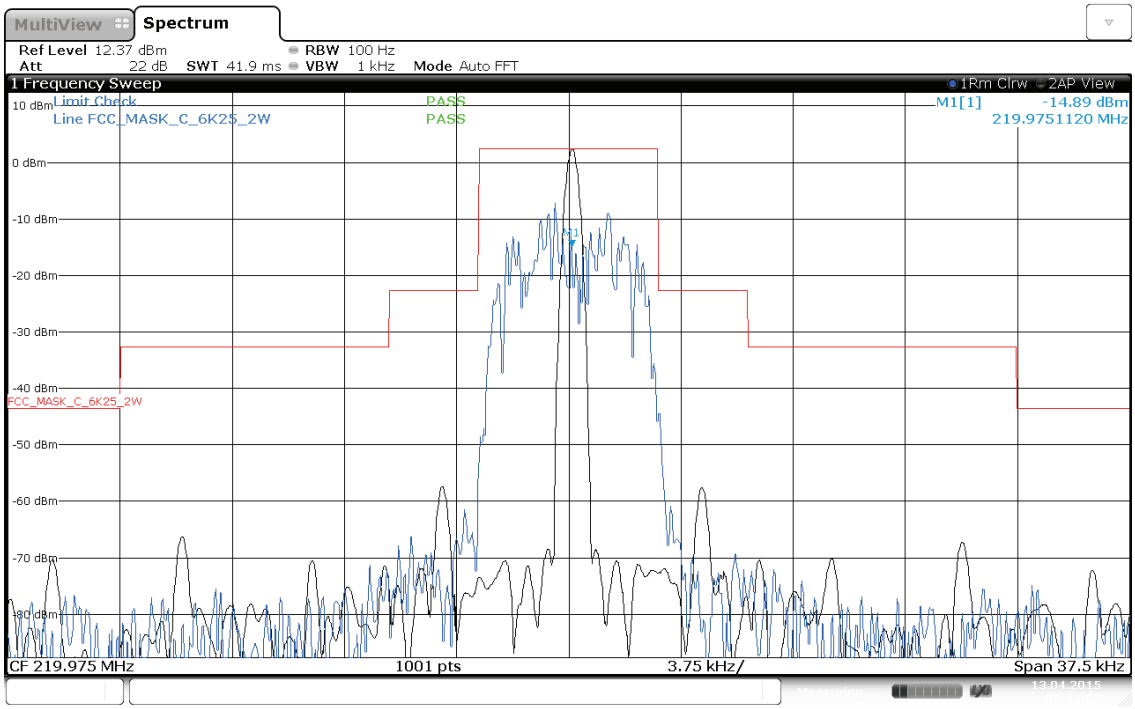
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:00:11

GRAPH 19: Spectrum for Emission 6.25 kHz D8PSK

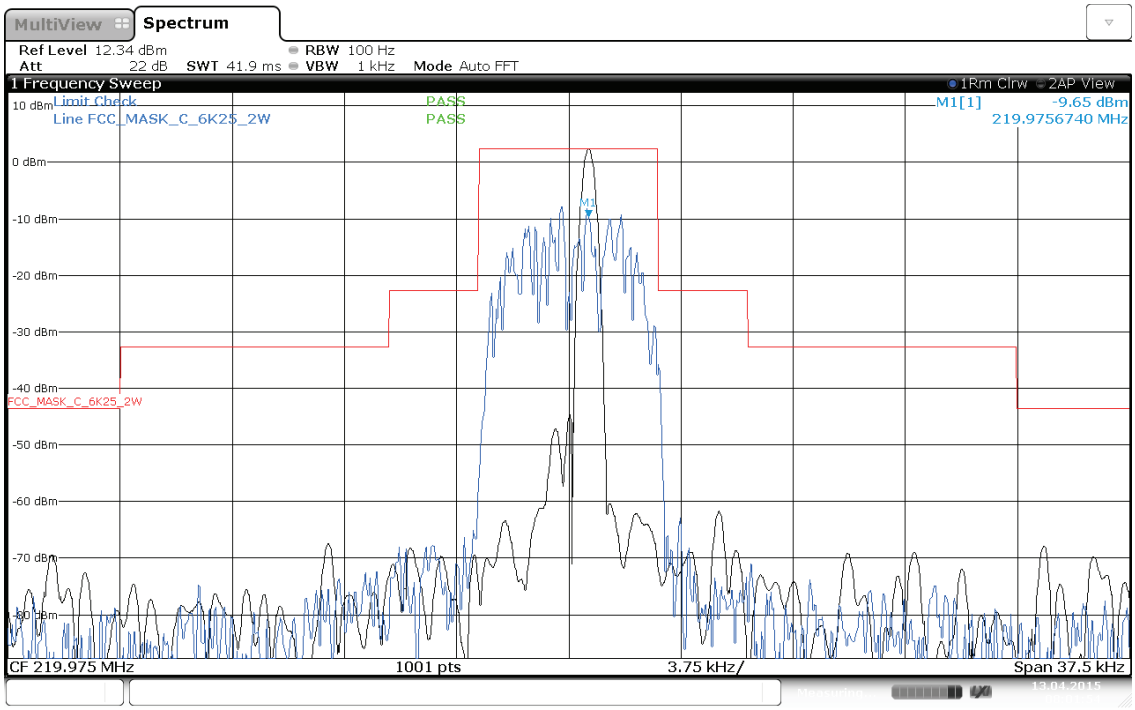
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:01:03

GRAPH 20: Spectrum for Emission 6.25 kHz π/4-DQPSK

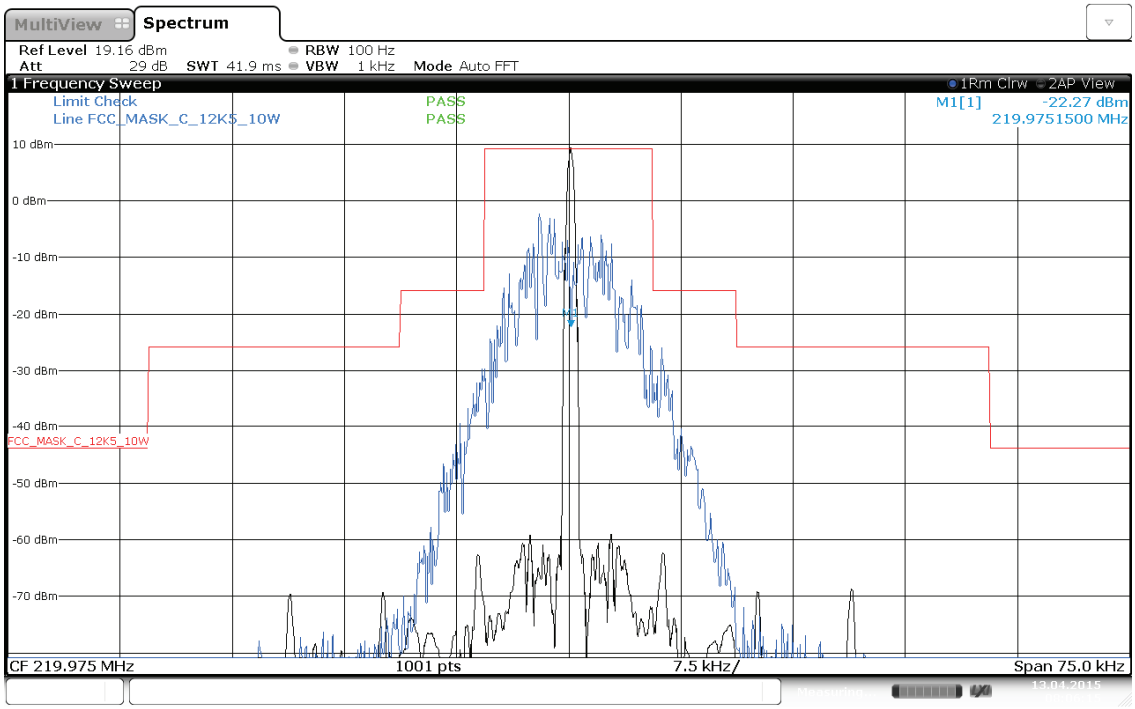
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:01:54

GRAPH 21: Spectrum for Emission 12.5 kHz 4-CPFSK

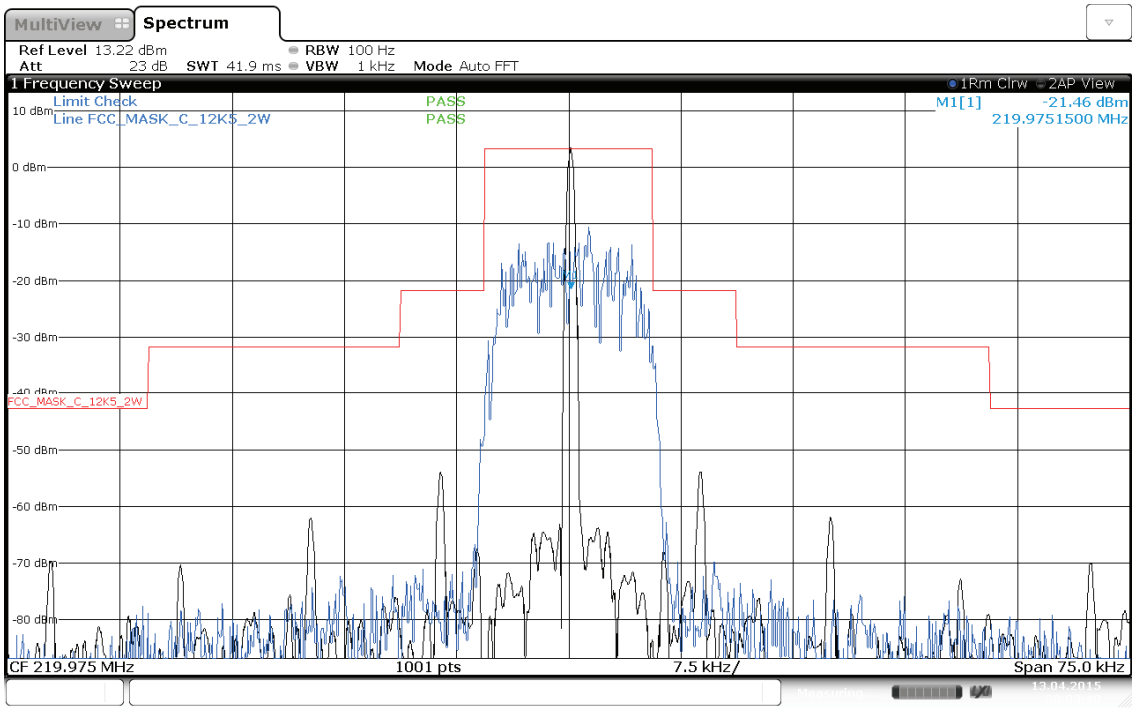
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:06:15

GRAPH 22: Spectrum for Emission 12.5 kHz 16-DEQAM

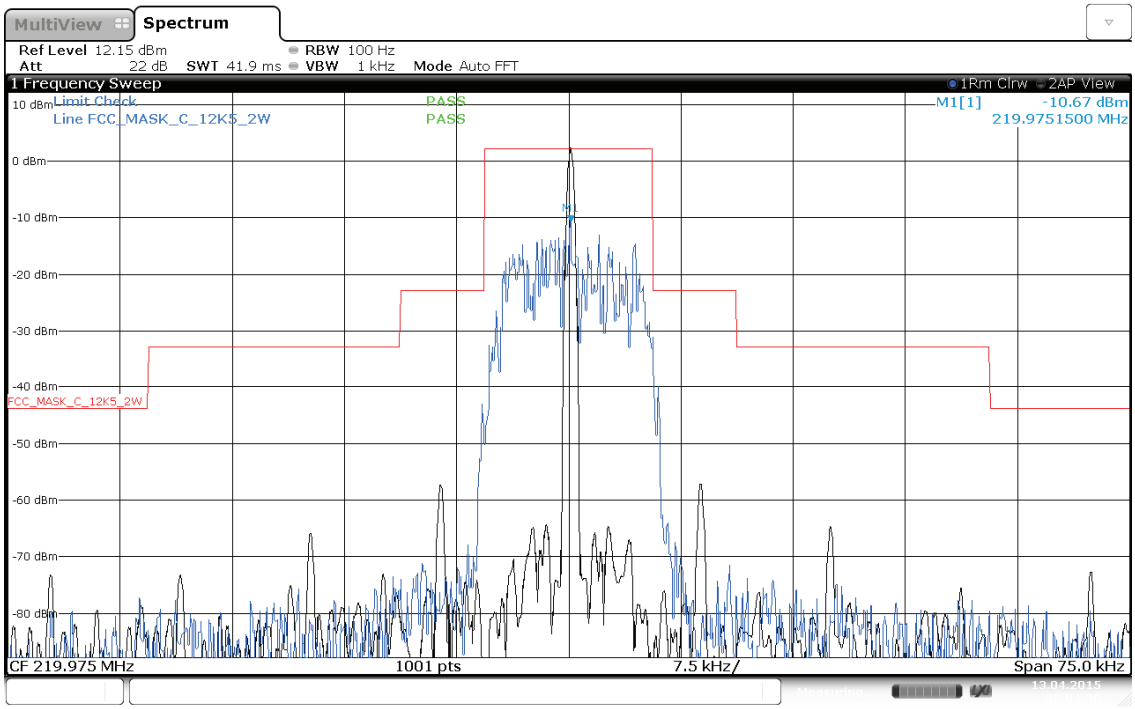
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:03:39

GRAPH 23: Spectrum for Emission 12.5 kHz D8PSK

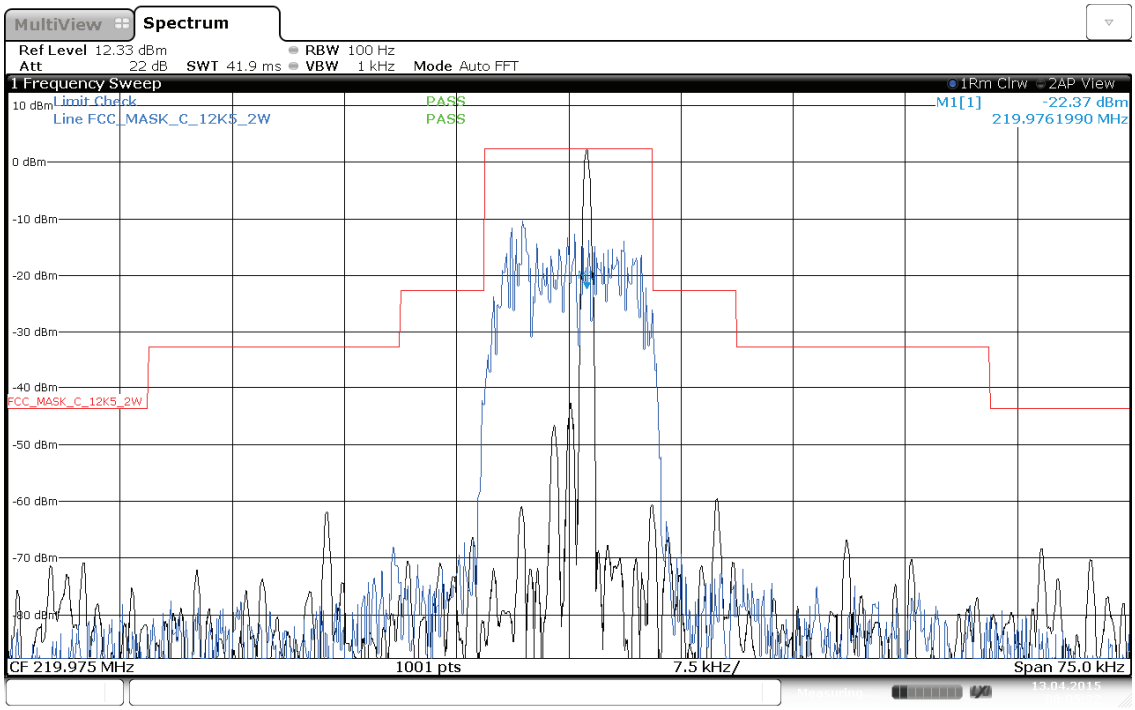
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:04:31

GRAPH 24: Spectrum for Emission 12.5 kHz π/4-DQPSK

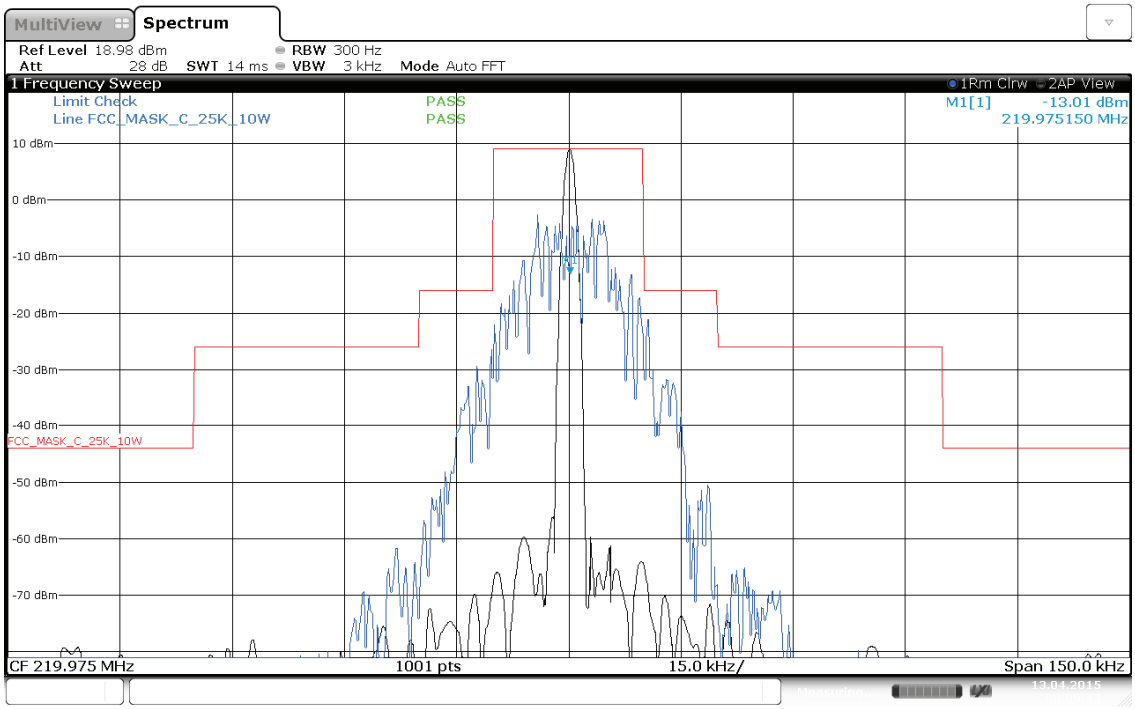
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:05:22

GRAPH 25: Spectrum for Emission 25 kHz 4-CPFSK

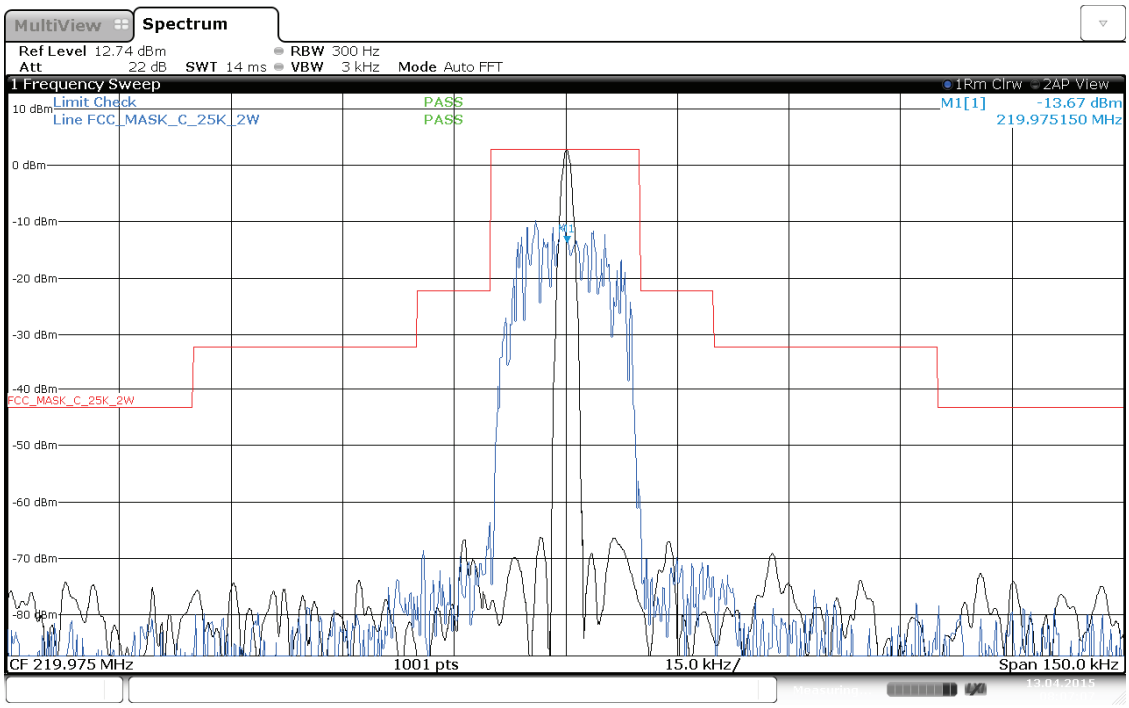
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:09:42

GRAPH 26: Spectrum for Emission 25 kHz 16-DEQAM

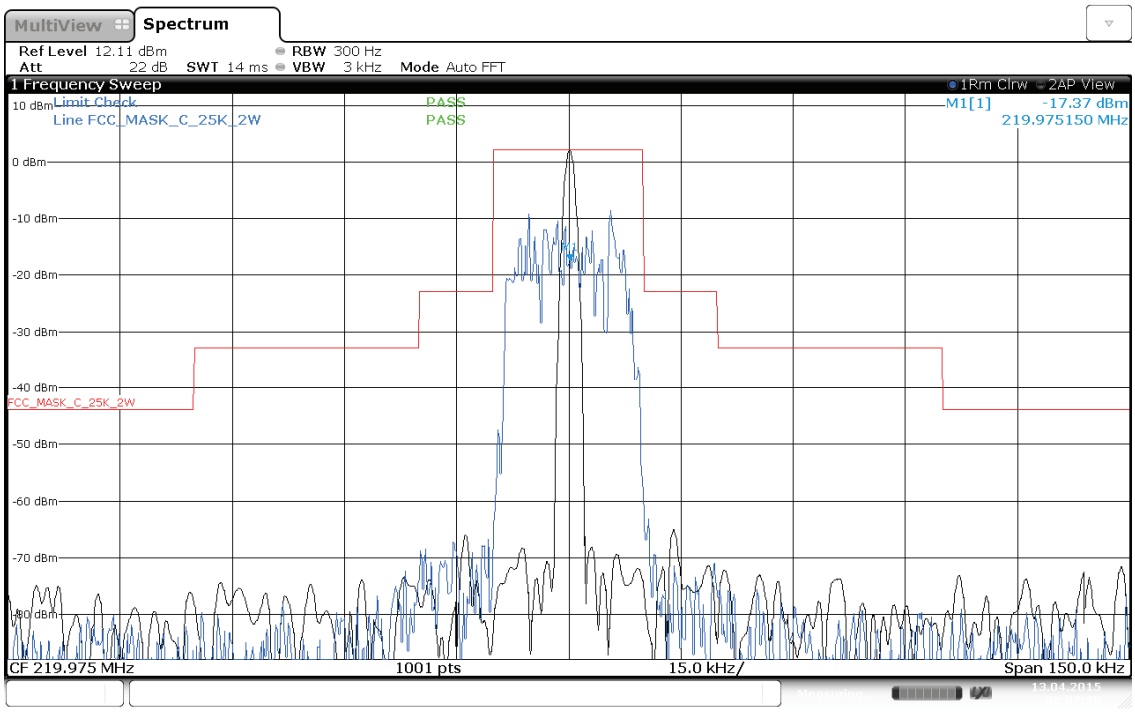
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:07:07

GRAPH 27: Spectrum for Emission 25 kHz D8PSK

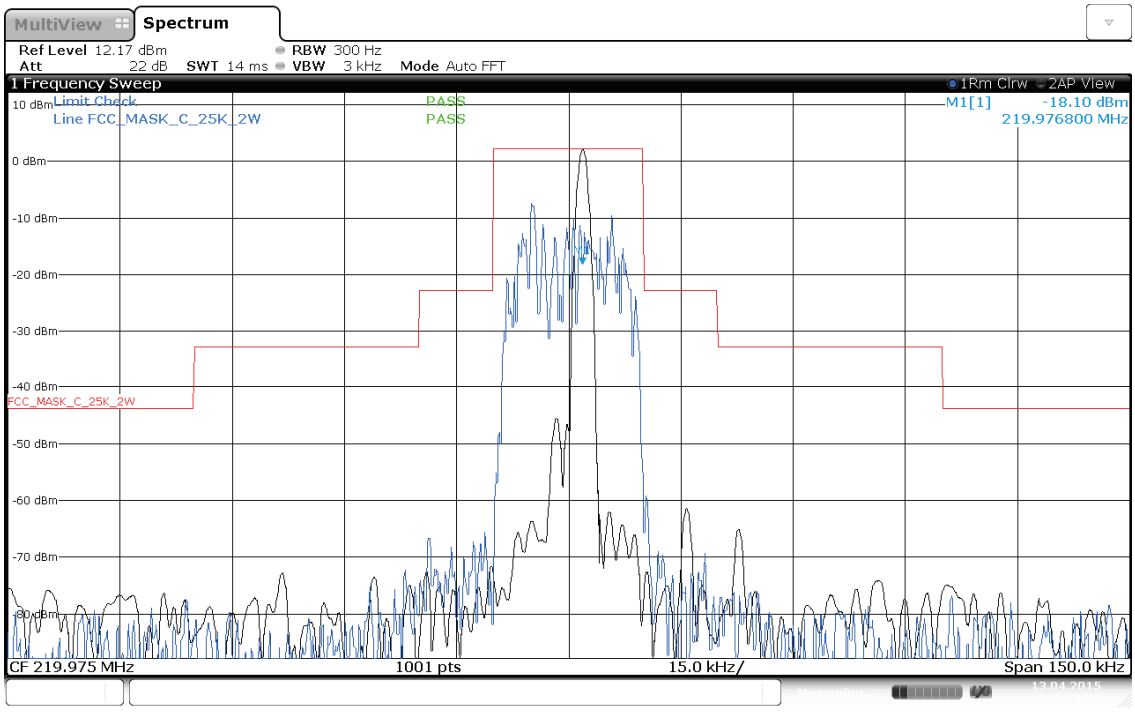
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:07:59

GRAPH 28: Spectrum for Emission 25 kHz π/4-DQPSK

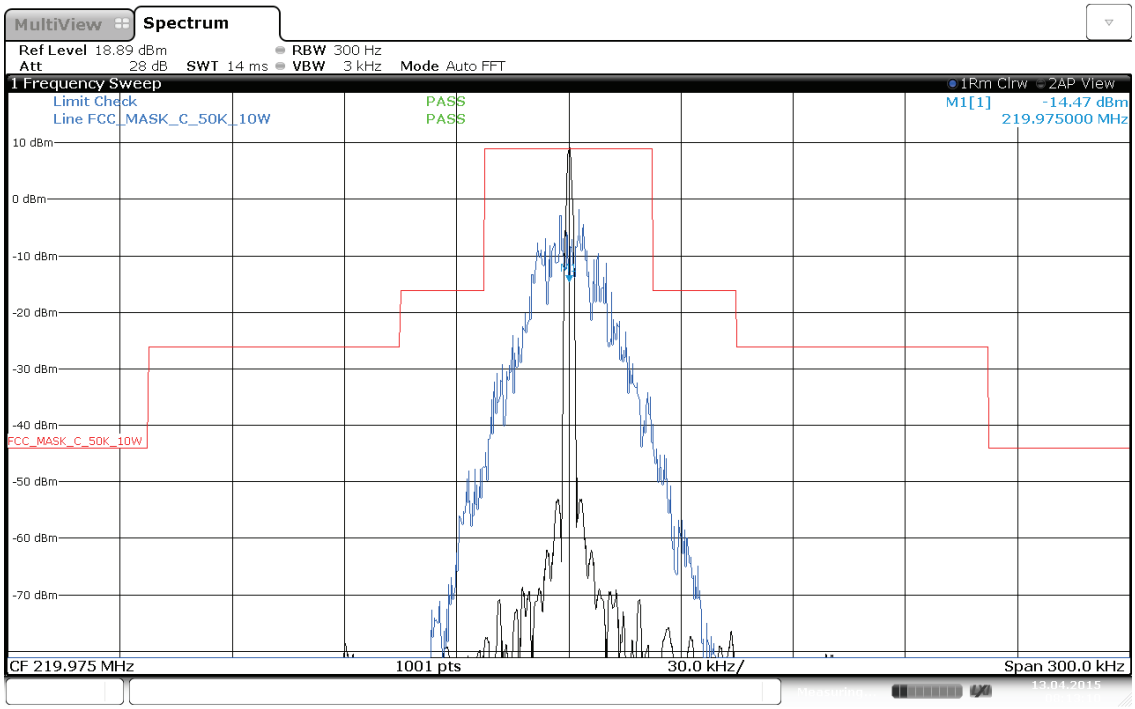
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:08:50

GRAPH 29: Spectrum for Emission 50 kHz 4-CPFSK

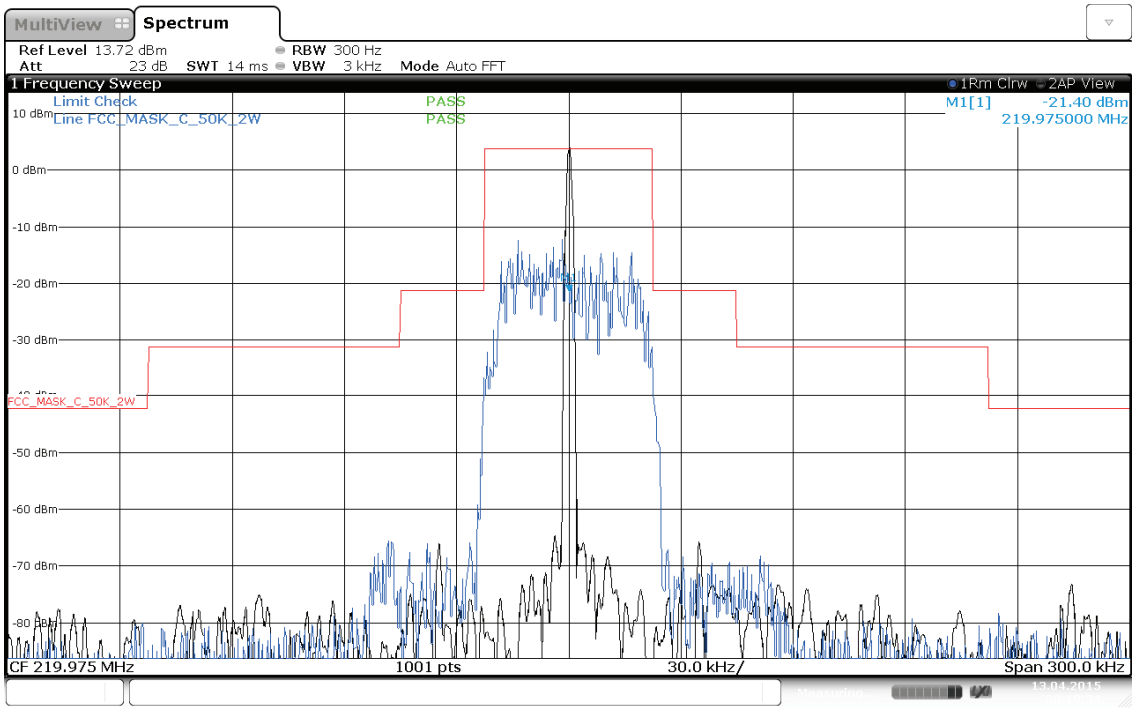
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:13:10

GRAPH 30: Spectrum for Emission 50 kHz 16-DEQAM

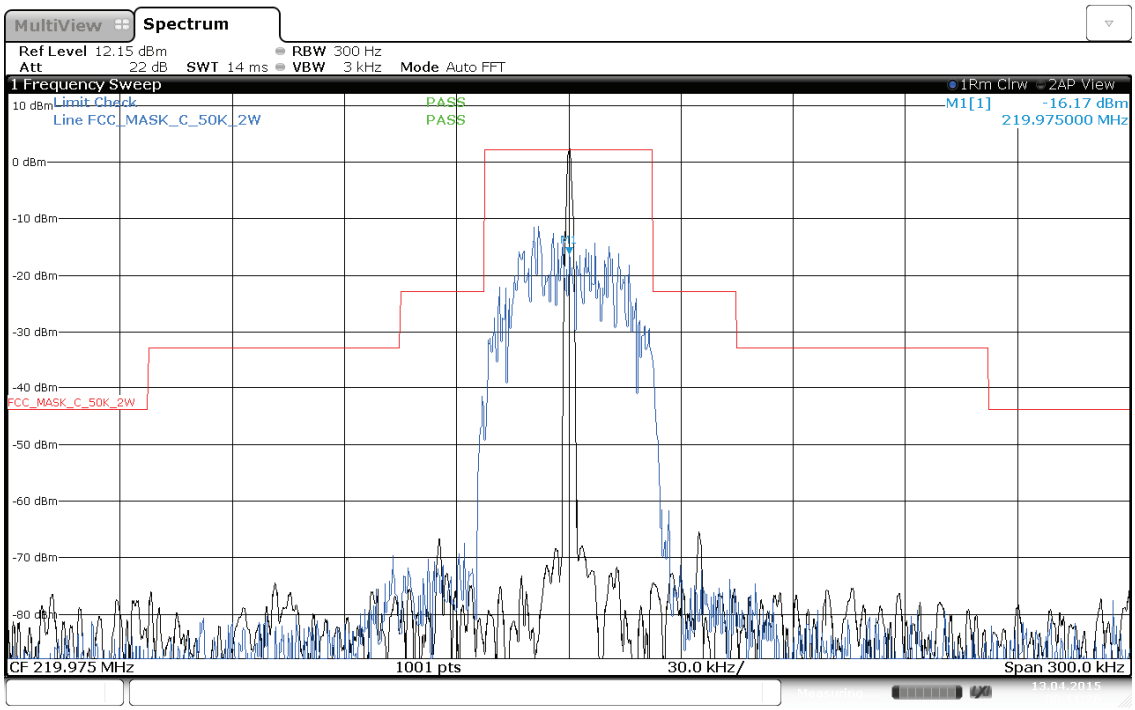
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:10:35

GRAPH 31: Spectrum for Emission 50 kHz D8PSK

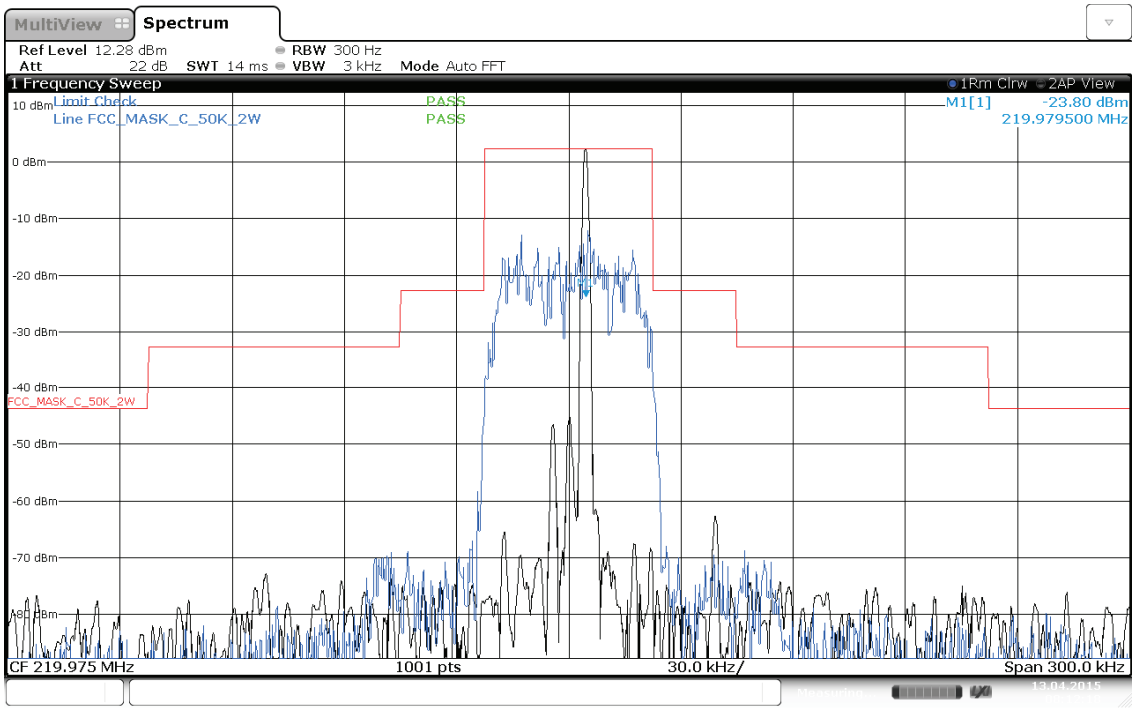
The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:11:26

GRAPH 32: Spectrum for Emission 50 kHz π/4-DQPSK

The total attenuation of the complete measuring assembly (at the frequency of the measurement), consisting of the 30dB attenuator, the losses of the measuring cables and connectors, is 30,5 dB.



Date: 13.APR.2015 08:12:18