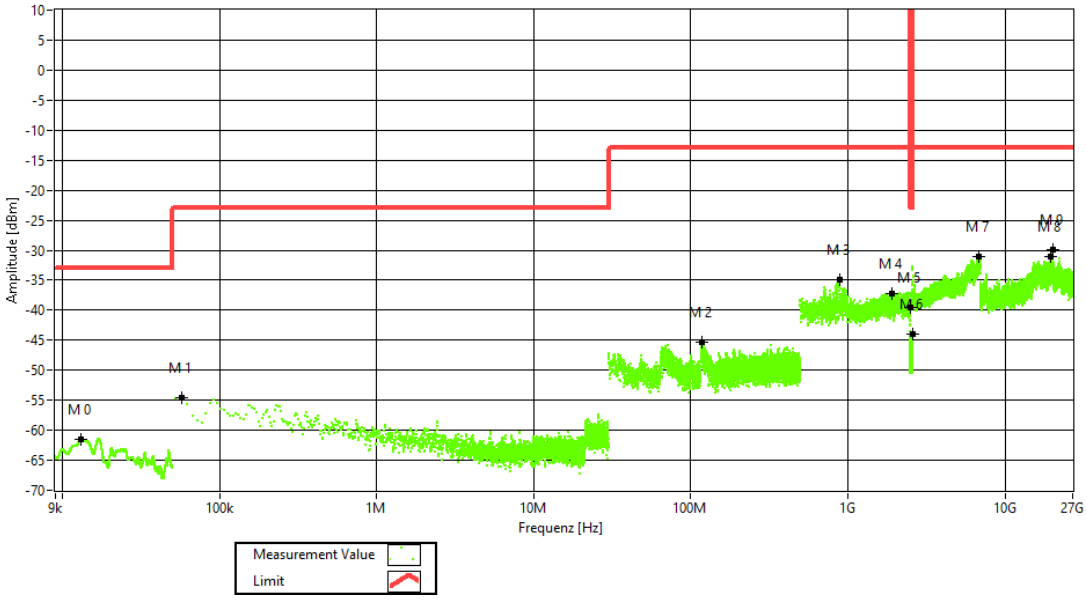
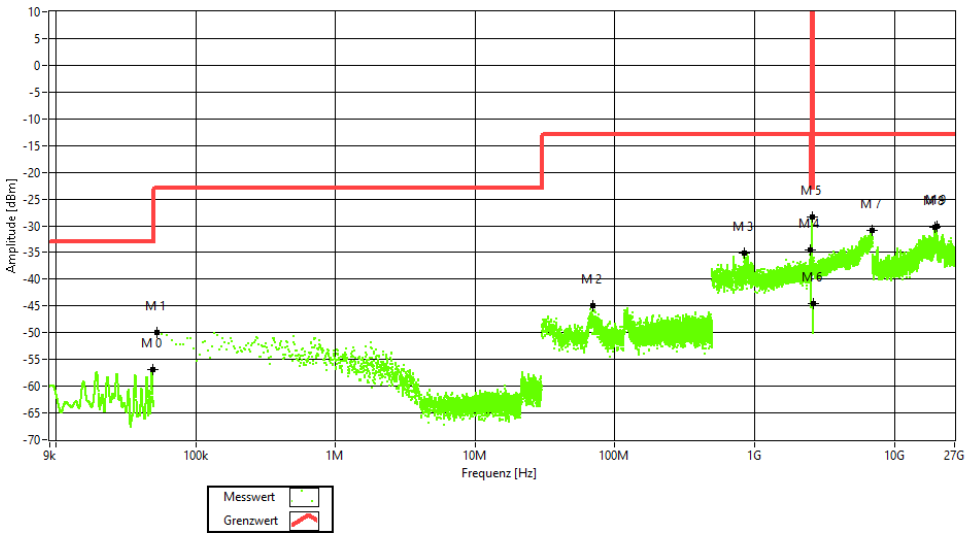
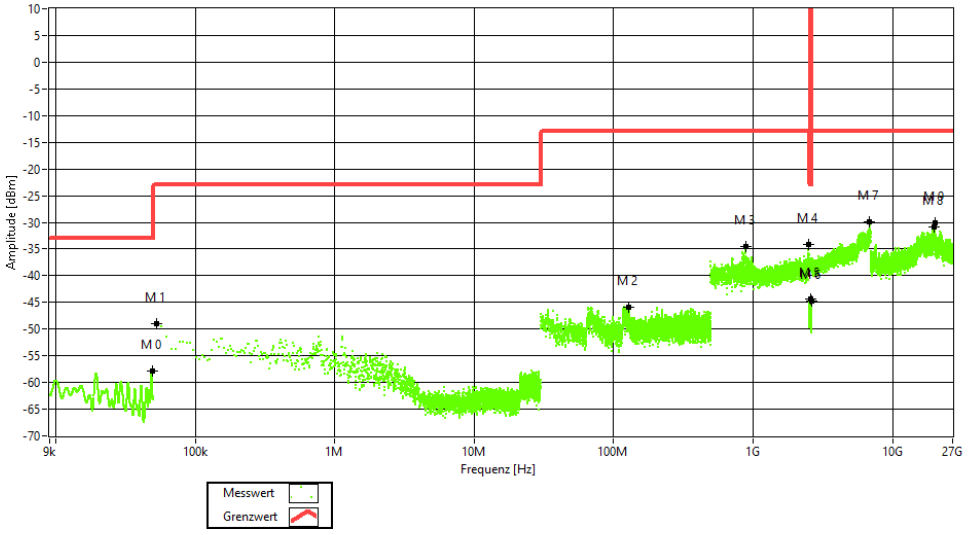
Frequency Band = BRS LBS, Test Frequency = high, Direction = RF downlink, Signal Type = GSM



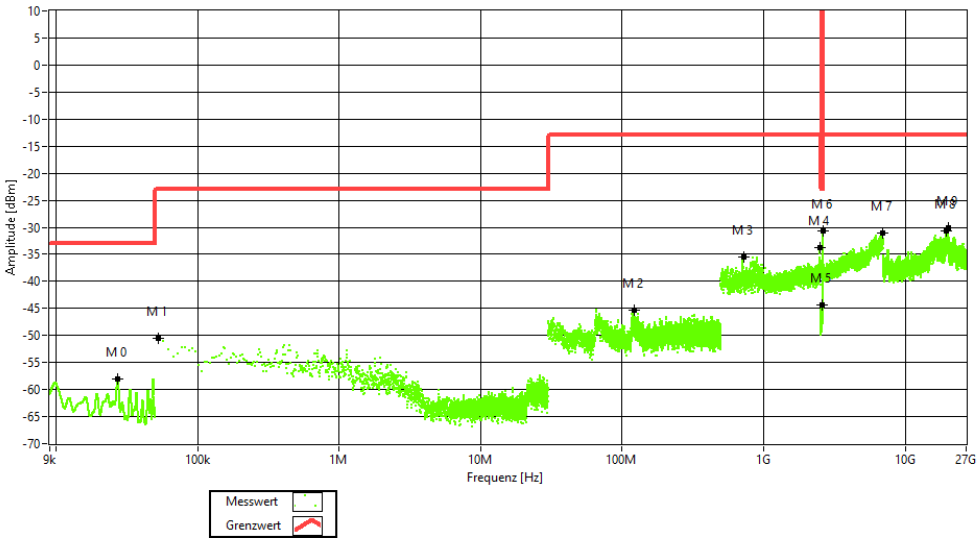
Frequency Band = BRS MBS, Test Frequency = low, Direction = RF downlink, Signal Type = AWGN



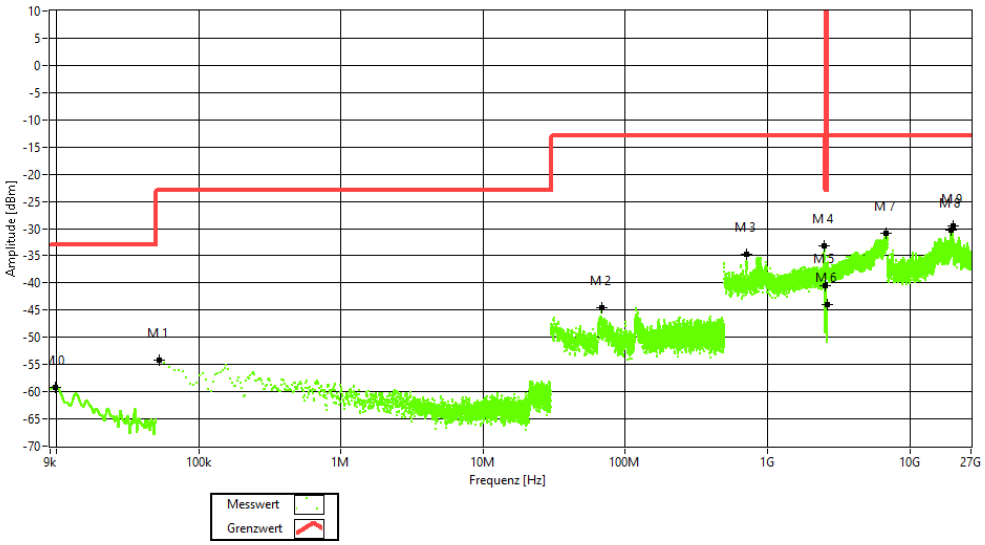
Frequency Band = BRS MBS, Test Frequency = mid, Direction = RF downlink, Signal Type = AWGN



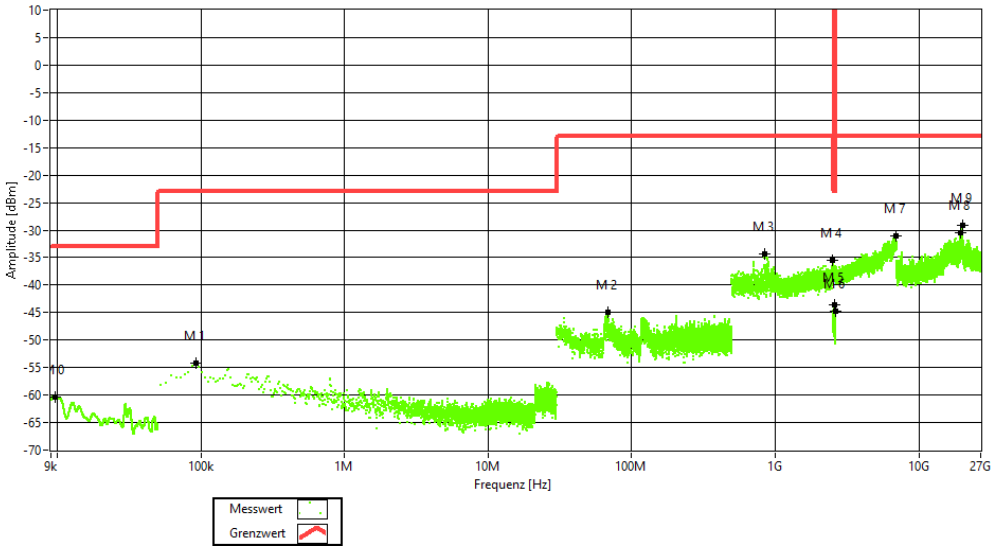
Frequency Band = BRS MBS, Test Frequency = high, Direction = RF downlink, Signal Type = AWGN



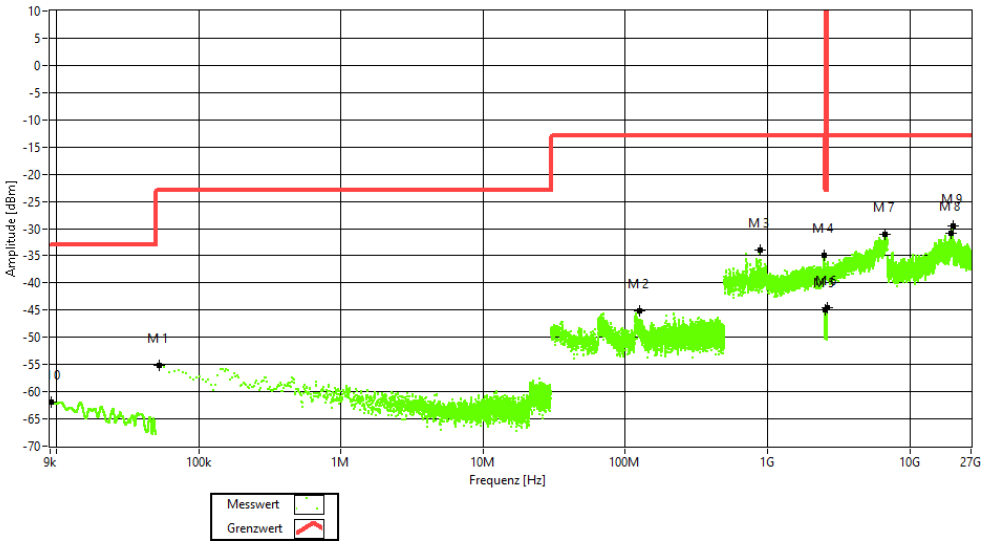
Frequency Band = BRS MBS, Test Frequency = low, Direction = RF downlink, Signal Type = GSM



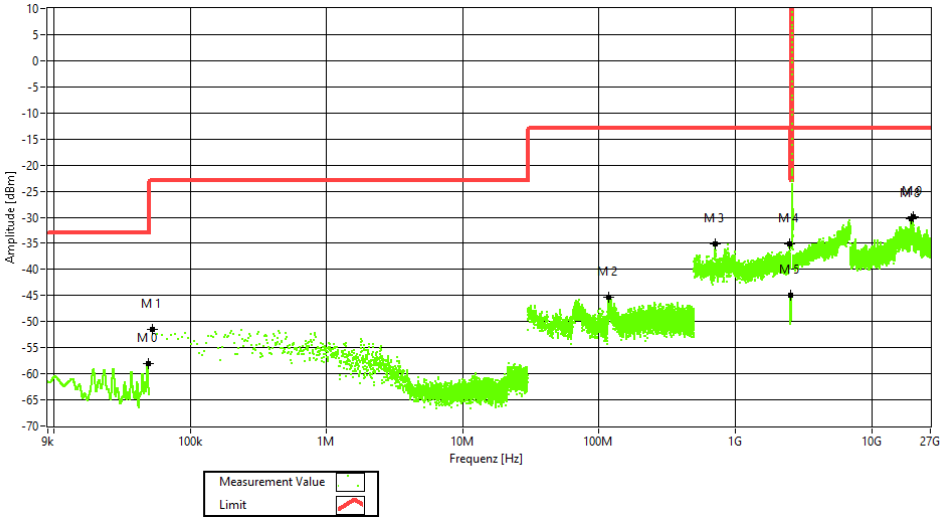
Frequency Band = BRS MBS, Test Frequency = mid, Direction = RF downlink, Signal Type = GSM



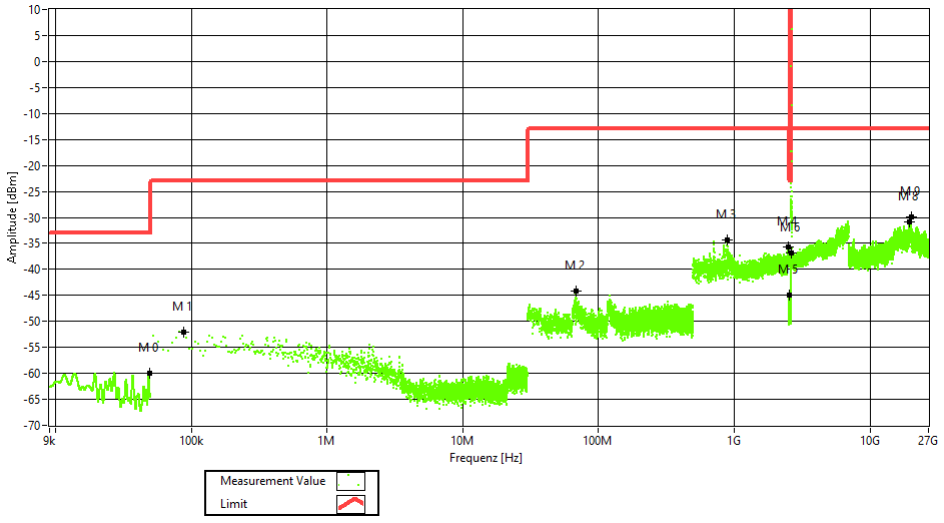
Frequency Band = BRS MBS, Test Frequency = high, Direction = RF downlink, Signal Type = GSM



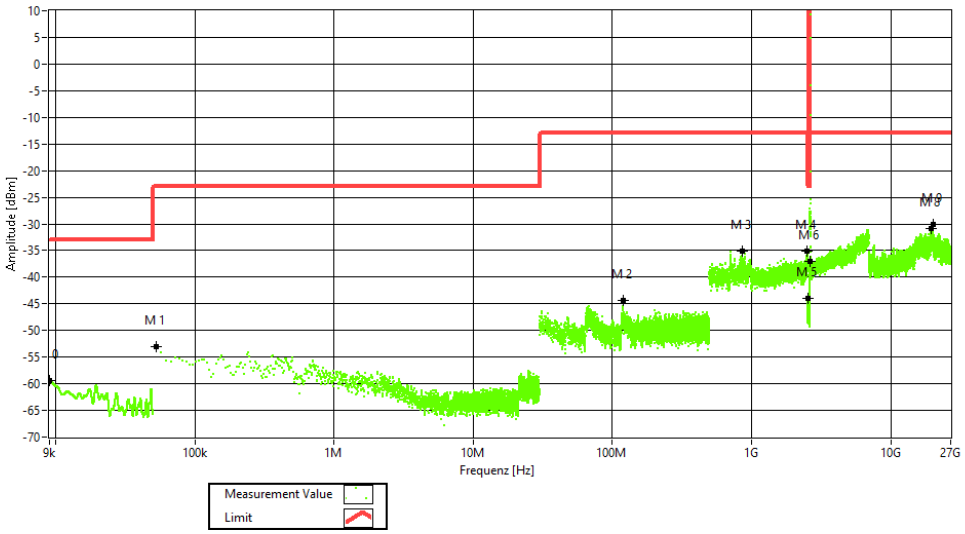
Frequency Band = BRS UBS, Test Frequency = low, Direction = RF downlink, Signal Type = AWGN



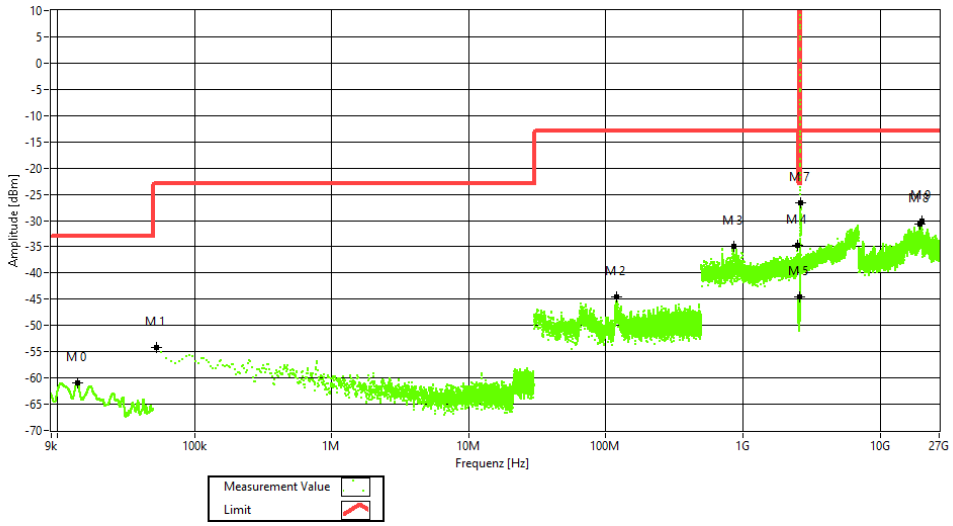
Frequency Band = BRS UBS, Test Frequency = mid, Direction = RF downlink, Signal Type = AWGN



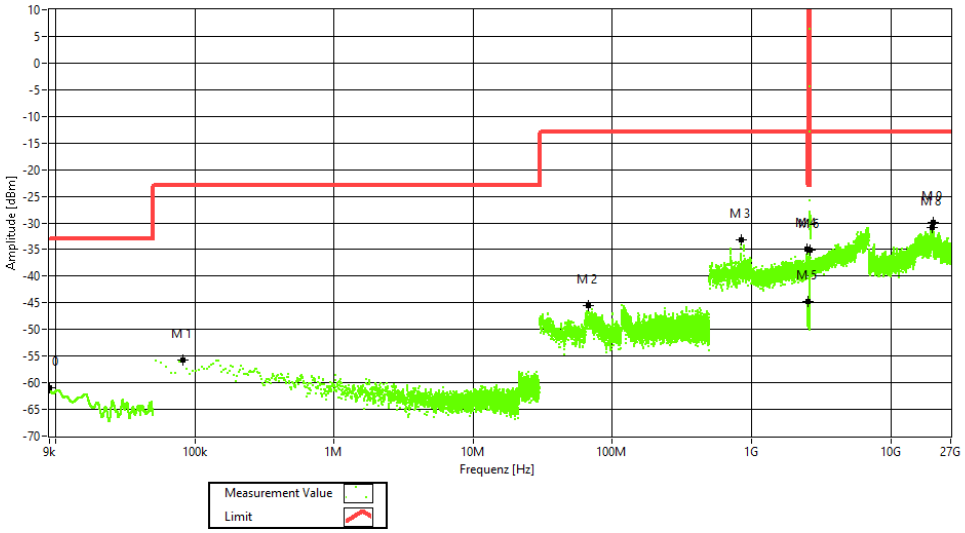
Frequency Band = BRS UBS, Test Frequency = high, Direction = RF downlink, Signal Type = AWGN



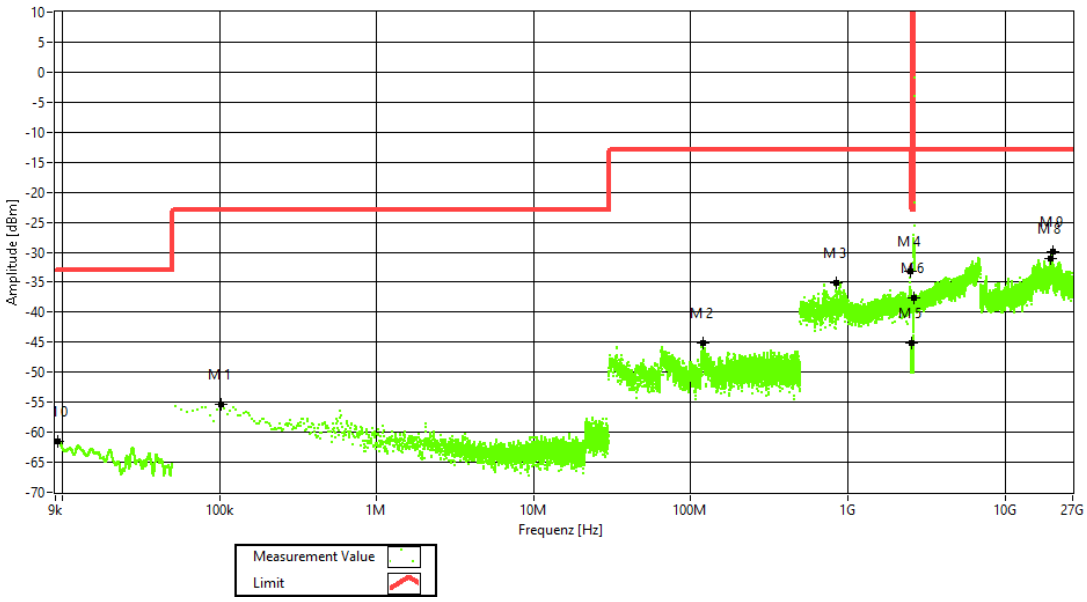
Frequency Band = BRS UBS, Test Frequency = low, Direction = RF downlink, Signal Type = GSM



Frequency Band = BRS UBS, Test Frequency = mid, Direction = RF downlink, Signal Type = GSM



Frequency Band = BRS UBS, Test Frequency = high, Direction = RF downlink, Signal Type = GSM



4.4.5 TEST EQUIPMENT USED

- Conducted

4.5 OUT-OF-BAND EMISSION LIMITS

Standard FCC Part § 2.1051, § 27.53

The test was performed according to:
ANSI C63.26, KDB 935210 D05 v01r04: 3.6

Test date: .2020-07-28 to 2020-07-30

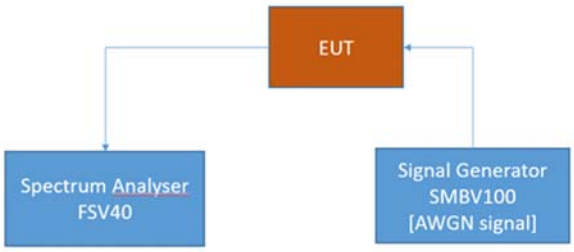
Environmental conditions: 25 ° C; 40 % r. F.

Test engineer: Thomas Hufnagel

4.5.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the out-of-band emission limit for industrial signal boosters. The limits itself come from the applicable rule part for each operating band per FCC § 2.1051, FCC § 27.53, RSS-GEN with subpart 6.13 and RSS-199 with subpart 4.5.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; Out-of-band emissions

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.5.2 TEST REQUIREMENTS/LIMITS

Abstract § 2.1051 from FCC:

FCC Part 2.1051; Measurement required: Spurious emissions at antenna terminal:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§27.53 – Emission limits

Abstract § 27.53 FCC:

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(1) Prior to the transition, and thereafter, solely within the MBS, for analog operations with an EIRP in excess of −9 dBW, the signal shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Abstract RSS-199 from ISED:

RSS-199; 4.5 Transmitter unwanted emissions

In the 1 MHz band immediately outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

Equipment shall comply with the following unwanted emission limits:

(a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least 43 + 10 log10 p.

(i) 40 + 10 log10 p from the channel edges to 5 MHz away
(ii) 43 + 10 log10 p between 5 MHz and X MHz from the channel edges, and
(iii) 55 + 10 log10 p at X MHz and beyond from the channel edges.

In addition, the attenuation shall not be less than 43 + 10 log10 p on all frequencies between 2490.5 MHz and 2496 MHz, and 55 + 10 log10 p at or below 2490.5 MHz. (b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

4.5.3 TEST PROTOCOL

Band 41 BRS (LBS), downlink, Number of input signals = 1							
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
Wideband	-0.3 dB < AGC	upper	2565.50	1.1	-28.2	-13.0	15.2
Wideband	3 dB > AGC	upper	2565.50	4.4	-27.2	-13.0	14.2
Narrowband	-0.3 dB < AGC	upper	2567.80	1.7	-27.1	-13.0	14.1
Narrowband	3 dB > AGC	upper	2567.80	5.0	-26.9	-13.0	13.9
Wideband	-0.3 dB < AGC	lower	2498.50	2.1	-23.8	-13.0	10.8
Wideband	3 dB > AGC	lower	2498.50	5.4	-35.9	-13.0	22.9
Narrowband	-0.3 dB < AGC	lower	2496.20	2.5	-28.2	-13.0	15.2
Narrowband	3 dB > AGC	lower	2496.20	5.8	-27.2	-13.0	14.2

Band 41 BRS (LBS), downlink, Number of input signals = 2								
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency f1 [MHz]**	**Signal Frequency f2 [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
WB	-0.3 dB < AGC	upper	2565.50	2563.00	1.1	-28.1	-13.0	15.1
WB	3 dB > AGC	upper	2565.50	2563.00	4.4	-26.8	-13.0	13.8
NB	-0.3 dB < AGC	upper	2567.80	2567.60	1.7	-29.2	-13.0	16.2
NB	3 dB > AGC	upper	2567.80	2567.60	5.0	-29.0	-13.0	16.0
WB	-0.3 dB < AGC	lower	2498.50	2501.00	2.1	-26.7	-13.0	13.7
WB	3 dB > AGC	lower	2498.50	2501.00	5.4	-35.8	-13.0	22.8
NB	-0.3 dB < AGC	lower	2496.20	2496.40	2.5	-28.2	-13.0	15.2
NB	3 dB > AGC	lower	2496.20	2406.40	5.8	-49.2	-13.0	36.2

Band 41 BRS (MBS), downlink, Number of input signals = 1							
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
Wideband	-0.3 dB < AGC	upper	2611.50	-0.5	-24.8	-13.0	11.8
Wideband	3 dB > AGC	upper	2611.50	2.8	-26.6	-13.0	13.6
Narrowband	-0.3 dB < AGC	upper	2613.80	-0.5	-22.2	-13.0	9.2
Narrowband	3 dB > AGC	upper	2613.80	2.8	-20.4	-13.0	7.4
Wideband	-0.3 dB < AGC	lower	2574.50	0.1	-24.3	-13.0	11.3
Wideband	3 dB > AGC	lower	2574.50	3.4	-35.2	-13.0	22.2
Narrowband	-0.3 dB < AGC	lower	2572.20	0.1	-20.1	-13.0	7.1
Narrowband	3 dB > AGC	lower	2572.20	3.4	-49.1	-13.0	36.1

Band 41 BRS (MBS), downlink, Number of input signals = 2								
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency f1 [MHz]**	**Signal Frequency f2 [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
WB	-0.3 dB < AGC	upper	2611.50	2609.00	-0.5	-29.0	-13.0	16.0
WB	3 dB > AGC	upper	2611.50	2609.00	2.8	-27.6	-13.0	14.6
NB	-0.3 dB < AGC	upper	2613.80	2613.60	-0.5	-22.3	-13.0	9.3
NB	3 dB > AGC	upper	2613.80	2613.60	2.8	-22.9	-13.0	9.9
WB	-0.3 dB < AGC	lower	2574.50	2577.00	0.1	-27.2	-13.0	14.2
WB	3 dB > AGC	lower	2574.50	2577.00	3.4	-27.1	-13.0	14.1
NB	-0.3 dB < AGC	lower	2572.20	2572.40	0.1	-24.1	-13.0	11.1
NB	3 dB > AGC	lower	2572.20	2572.40	3.4	-49.0	-13.0	36.0

Band 41 BRS (UBS), downlink, Number of input signals = 1							
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
Wideband	-0.3 dB < AGC	upper	2651,50	2,1	-27,0	-13,0	14,0
Wideband	3 dB > AGC	upper	2651,50	5,4	-29,2	-13,0	16,2
Narrowband	-0.3 dB < AGC	upper	2653,80	1,9	-28,9	-13,0	15,9
Narrowband	3 dB > AGC	upper	2653,80	5,2	-29,5	-13,0	16,5
Wideband	-0.3 dB < AGC	lower	2620,50	3,1	-21,2	-13,0	8,2
Wideband	3 dB > AGC	lower	2620,50	6,4	-35,3	-13,0	22,3
Narrowband	-0.3 dB < AGC	lower	2618,20	2,9	-25,9	-13,0	12,9
Narrowband	3 dB > AGC	lower	2618,20	6,2	-49,1	-13,0	36,1

Band 41 BRS (UBS), downlink, Number of input signals = 2								
Signal Type	**Input Power**	**Band Edge**	**Signal Frequency f1 [MHz]**	**Signal Frequency f2 [MHz]**	**Input Power [dBm]**	**Maximum Out-of-band Power [dBm]**	**Limit Out-of-band Power [dBm]**	**Margin to Limit [dB]**
WB	-0.3 dB < AGC	upper	2651,50	2649,00	2,1	-30,5	-13,0	17,5
WB	3 dB > AGC	upper	2651,50	2649,00	5,4	-31,8	-13,0	18,8
NB	-0.3 dB < AGC	upper	2653,80	2653,60	1,9	-31,1	-13,0	18,1
NB	3 dB > AGC	upper	2653,80	2653,60	5,2	-31,2	-13,0	18,2
WB	-0.3 dB < AGC	lower	2620,50	2623,00	3,1	-25,0	-13,0	12,0
WB	3 dB > AGC	lower	2620,50	2623,00	6,4	-35,4	-13,0	22,4
NB	-0.3 dB < AGC	lower	2618,20	2618,40	2,9	-31,7	-13,0	18,7
NB	3 dB > AGC	lower	2618,20	2618,40	6,2	-29,9	-13,0	16,9

Remark: Please see next sub-clause for the measurement plot.

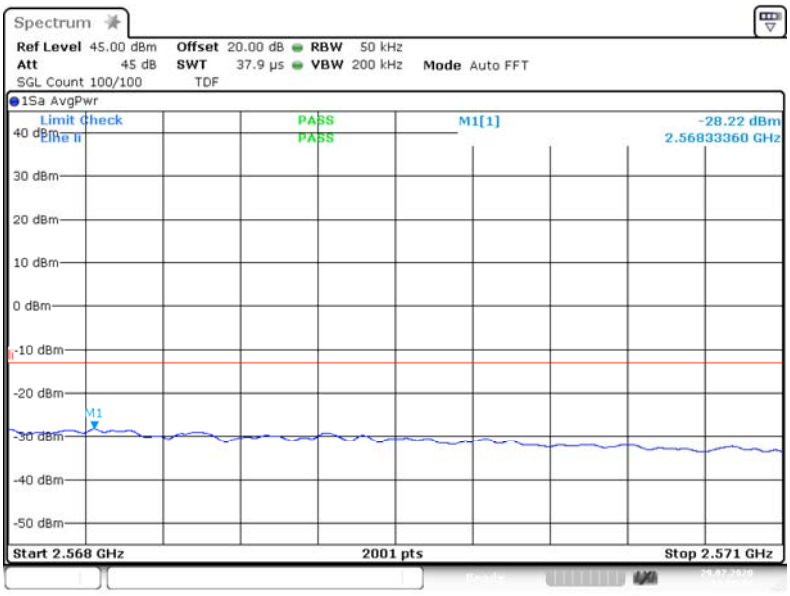
Explanations concering table with two input signals:

"WB" means Wideband.
"NB" means Narrowband.

-

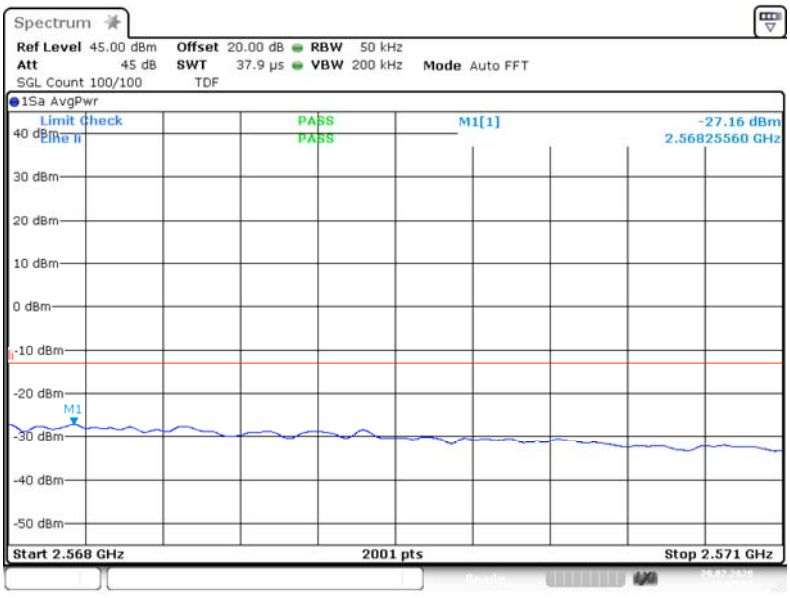
4.5.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



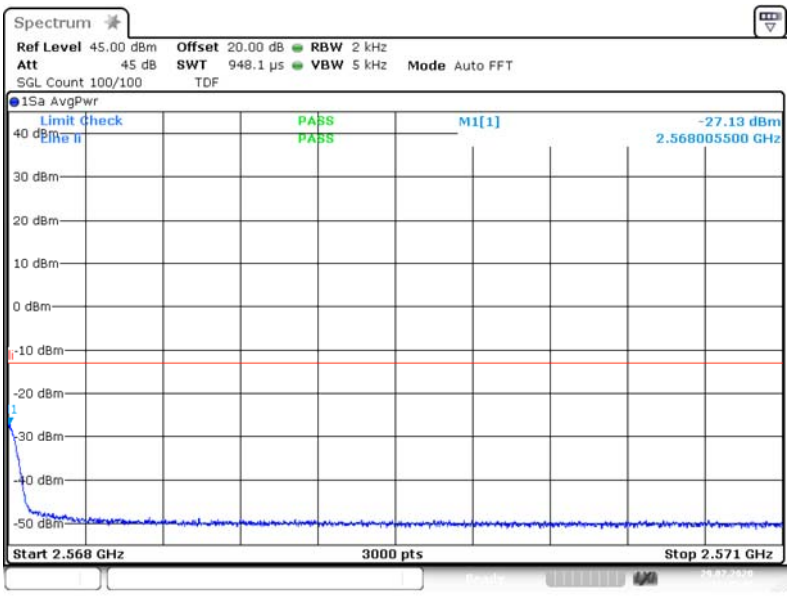
3.6.2 out of band emi BRS_Low AWGN upper 1carrier -0.3 dB 2.
568G 2.571G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1



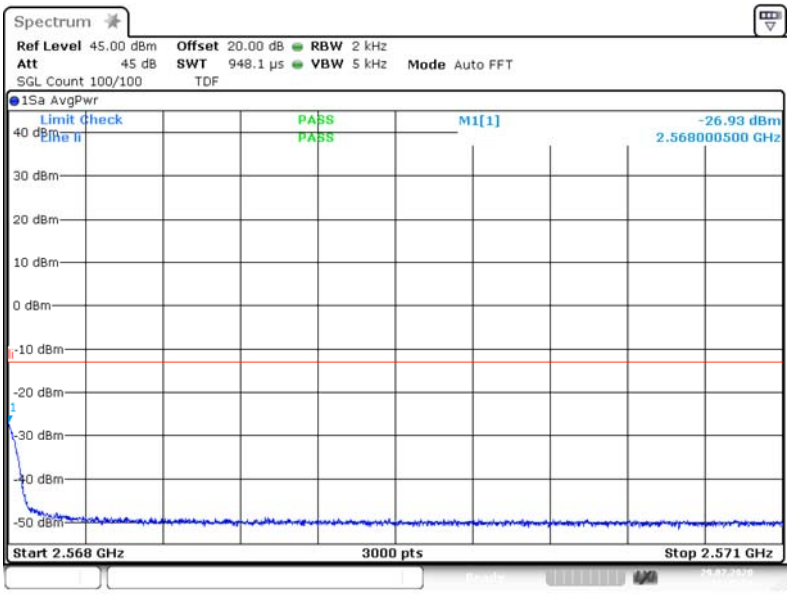
3.6.2 out of band emi BRS_Low AWGN upper 1carrier +3.0 dB 2.
568G 2.571G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



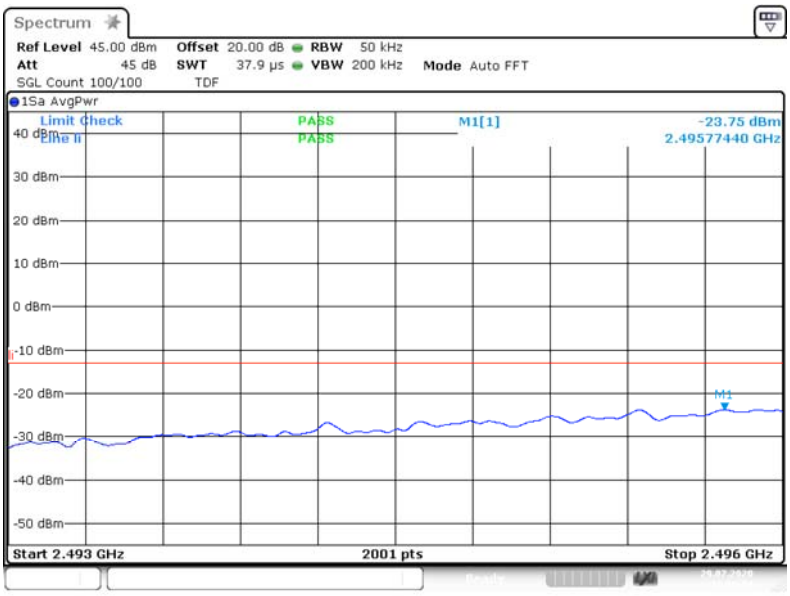
3.6.2 out of band emi BRS_Low GSM upper lcarrier -0.3 dB 2.5
68G 2.571G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1



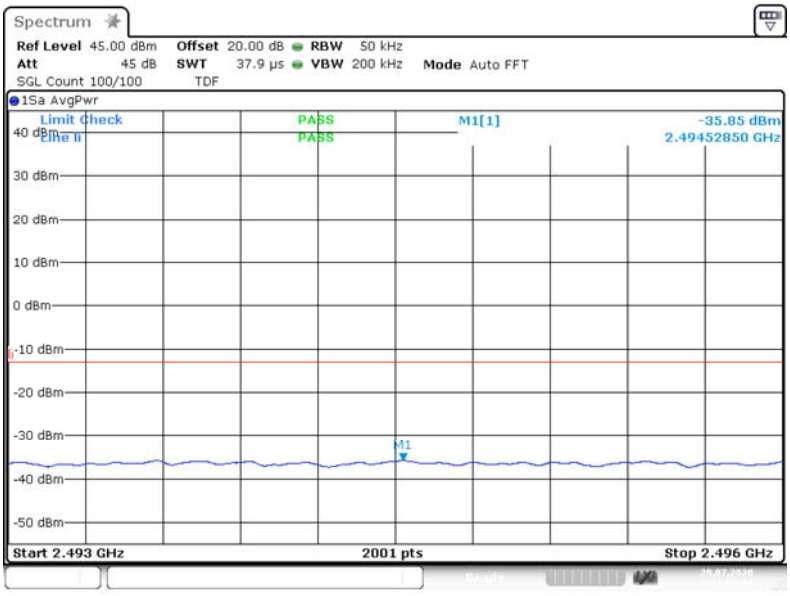
3.6.2 out of band emi BRS_Low GSM upper lcarrier +3.0 dB 2.5
68G 2.571G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



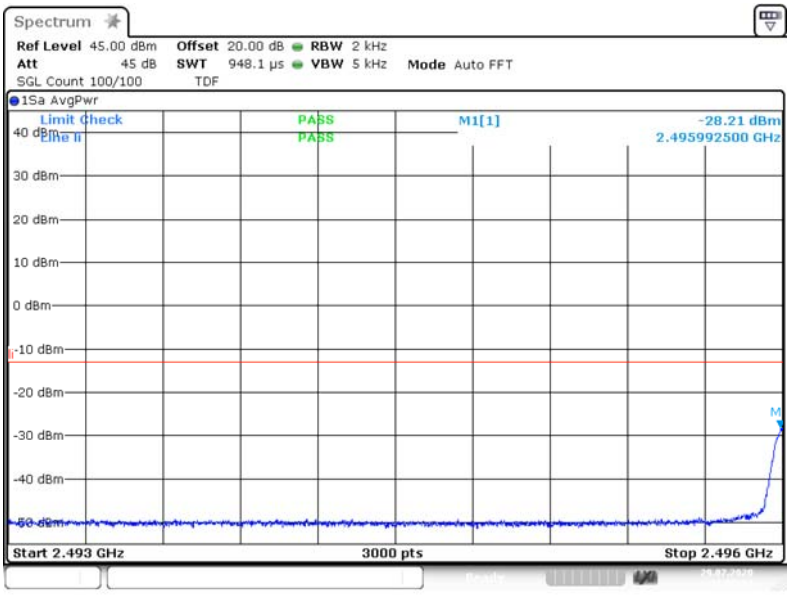
3.6.2 out of band emi BRS_Low AWGN lower 1carrier -0.3 dB 2.
493G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1



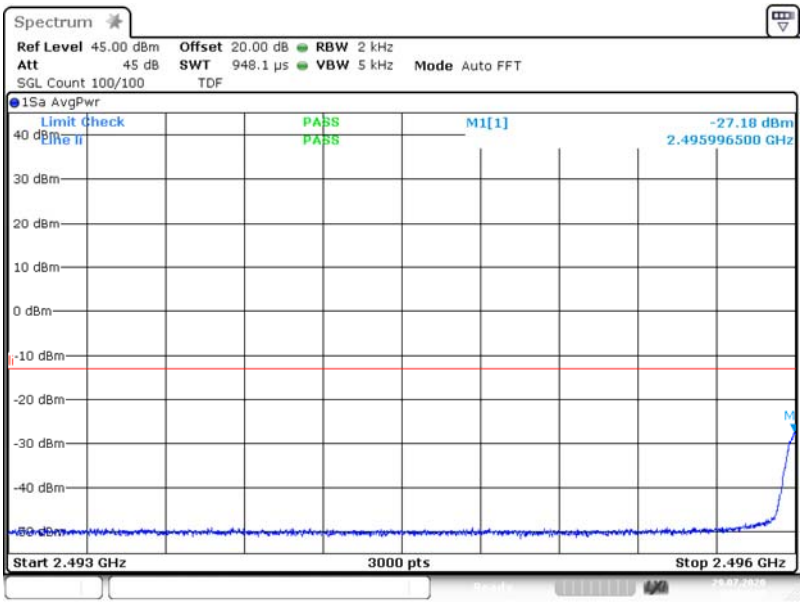
3.6.2 out of band emi BRS_Low AWGN lower 1carrier +3.0 dB 2.
493G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



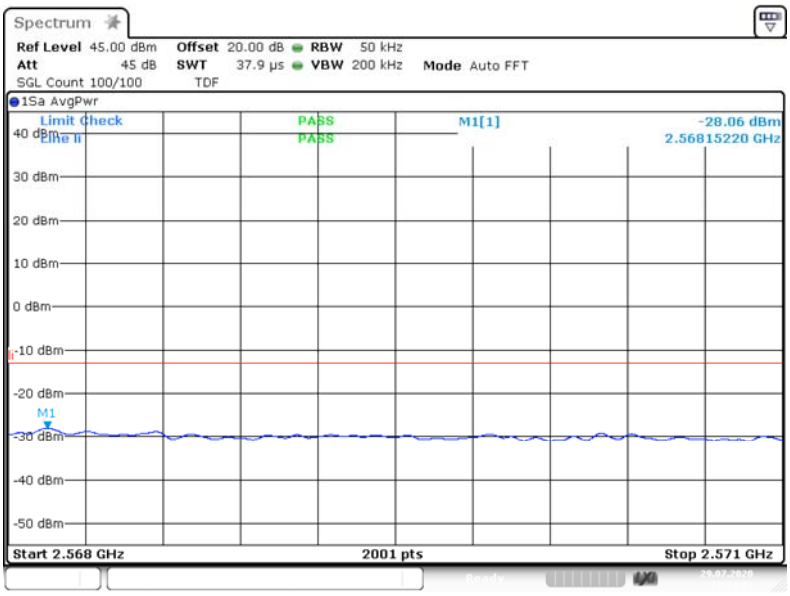
3.6.2 out of band emi BRS_Low GSM lower 1carrier -0.3 dB 2.4 93G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1



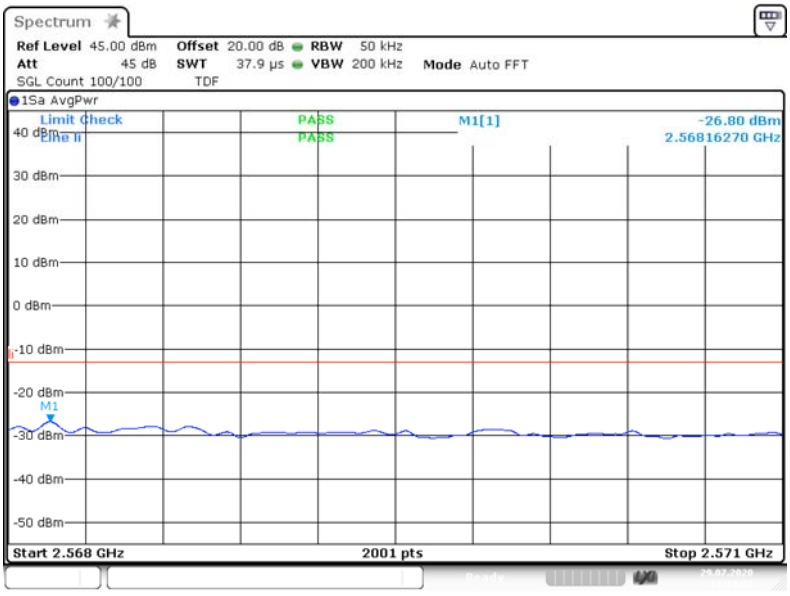
3.6.2 out of band emi BRS_Low GSM lower 1carrier +3.0 dB 2.4 93G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



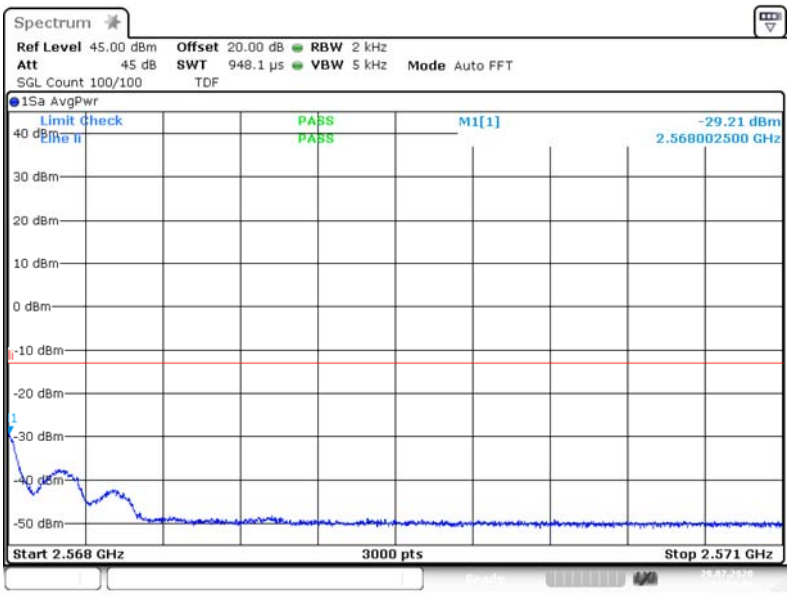
3.6.2 out of band emi BRS_Low AWGN upper 2carriers -0.3 dB 2
.568G 2.571G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2

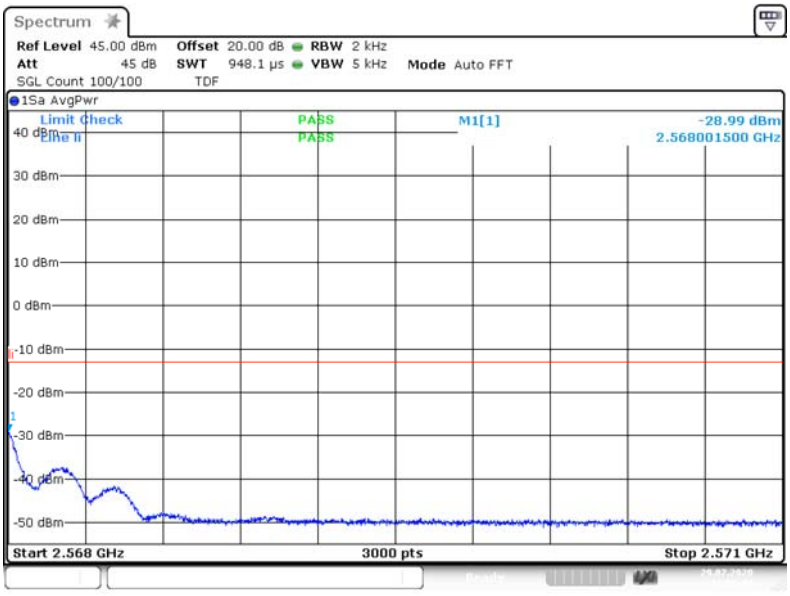


3.6.2 out of band emi BRS_Low AWGN upper 2carriers +3.0 dB 2
.568G 2.571G

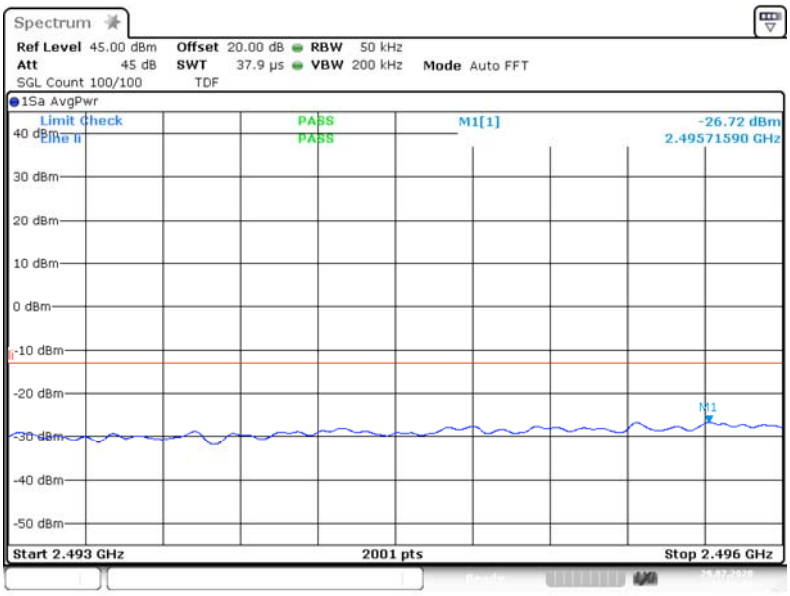
Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2

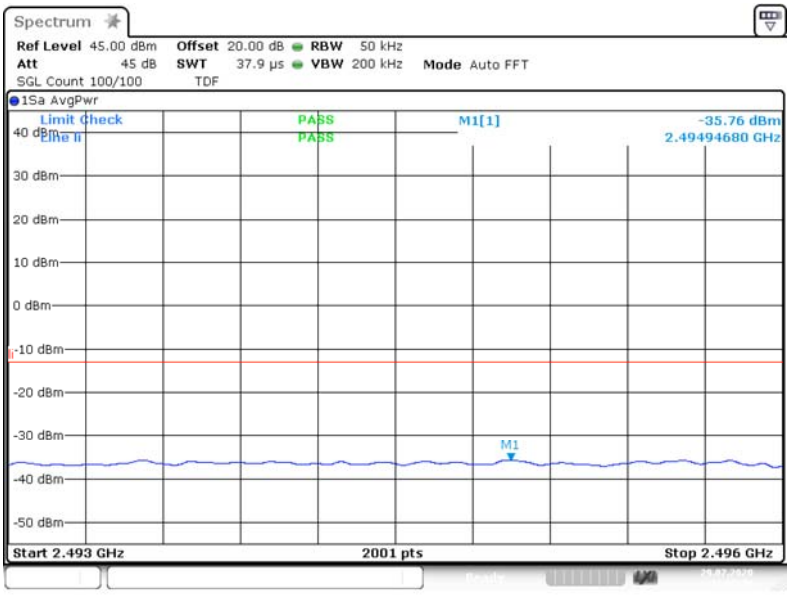


Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



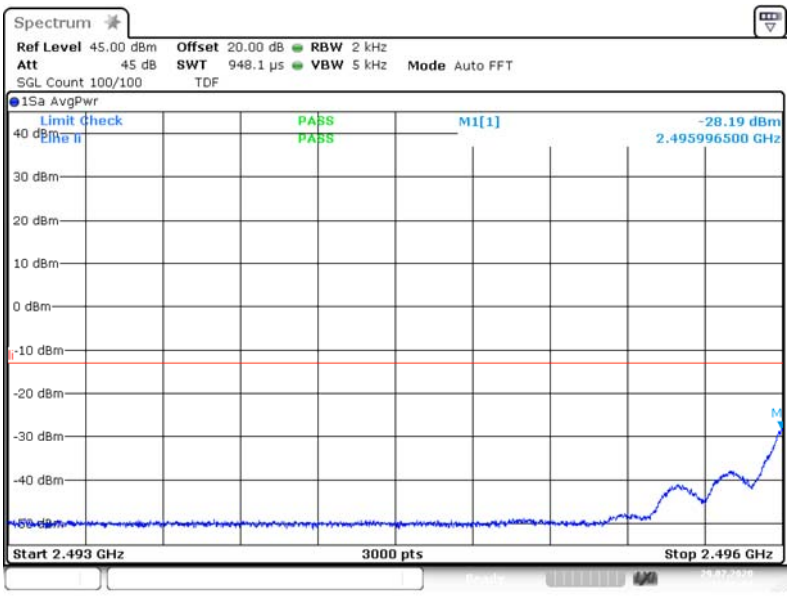
3.6.2 out of band emi BRS_Low AWGN lower 2carriers -0.3 dB 2
.493G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2



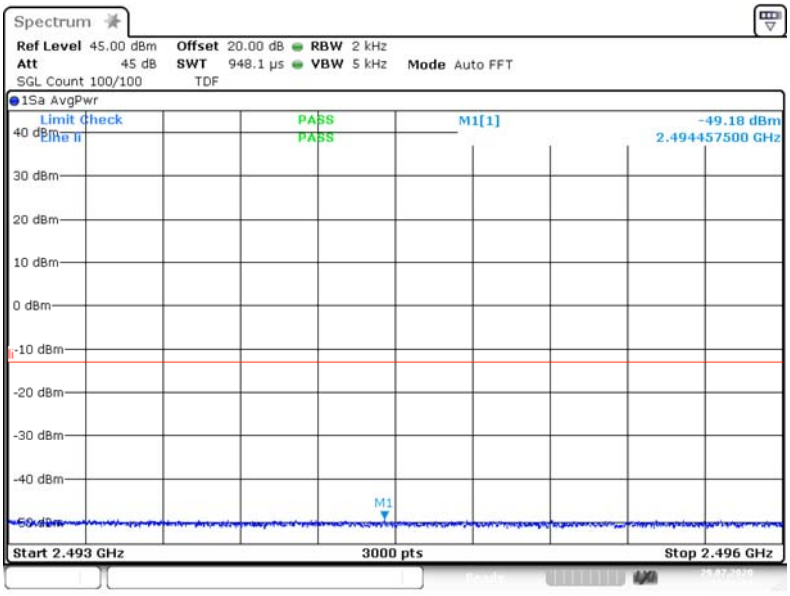
3.6.2 out of band emi BRS_Low AWGN lower 2carriers +3.0 dB 2
.493G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



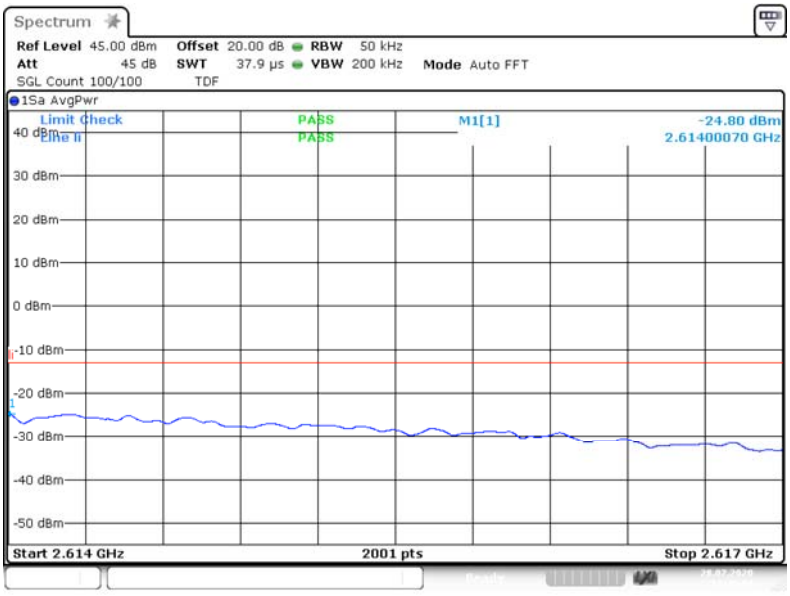
3.6.2 out of band emi BRS_Low GSM lower 2carriers -0.3 dB 2.
493G 2.496G

Band: BRS LBS; Frequency: 2.4960 GHz to 2.5680 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2



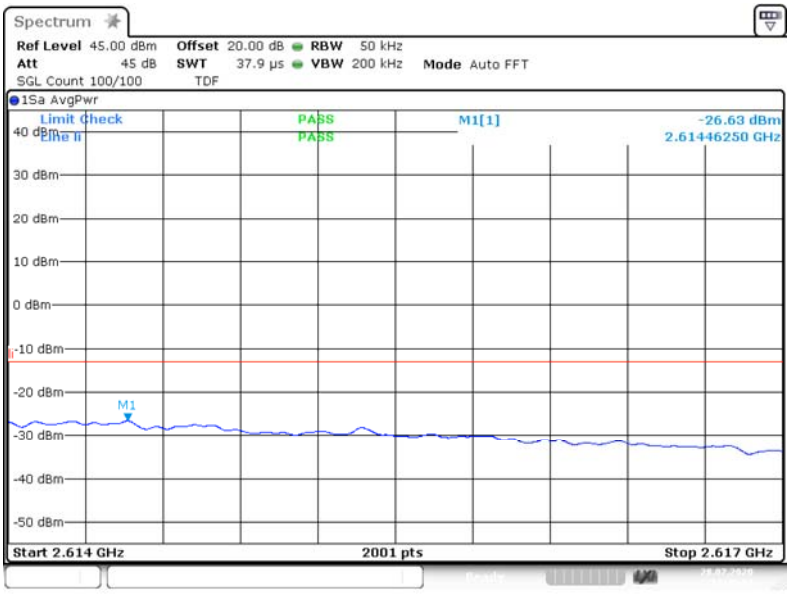
3.6.2 out of band emi BRS_Low GSM lower 2carriers +3.0 dB 2.
493G 2.496G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



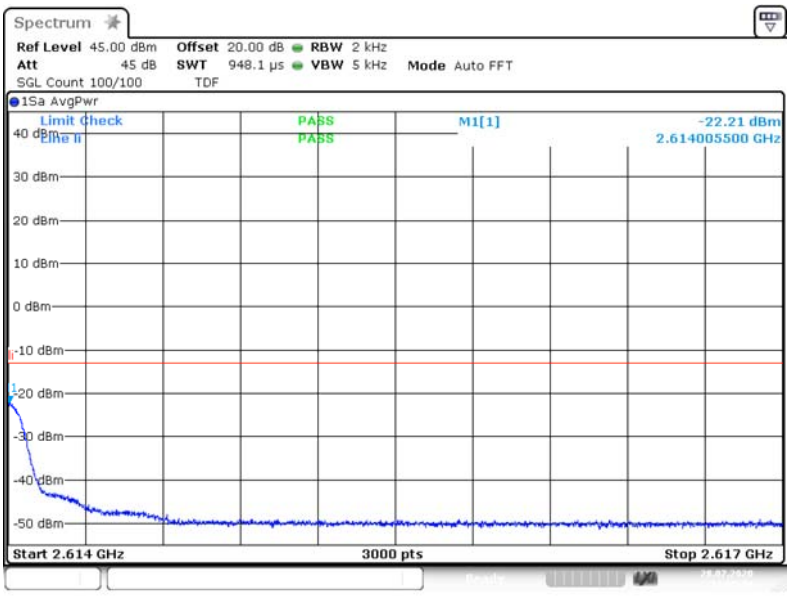
3.6.2 out of band emi BRS_Mid AWGN upper 1carrier -0.3 dB 2.
614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1



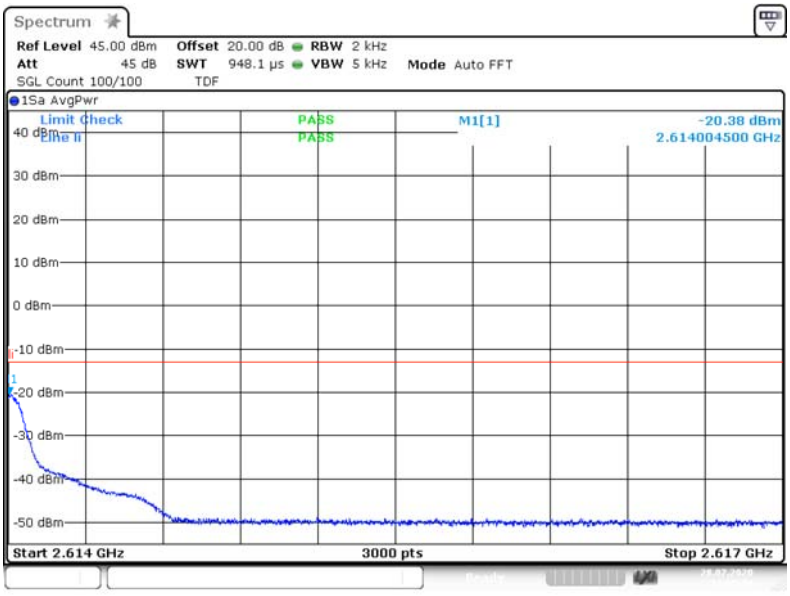
3.6.2 out of band emi BRS_Mid AWGN upper 1carrier +3.0 dB 2.
614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



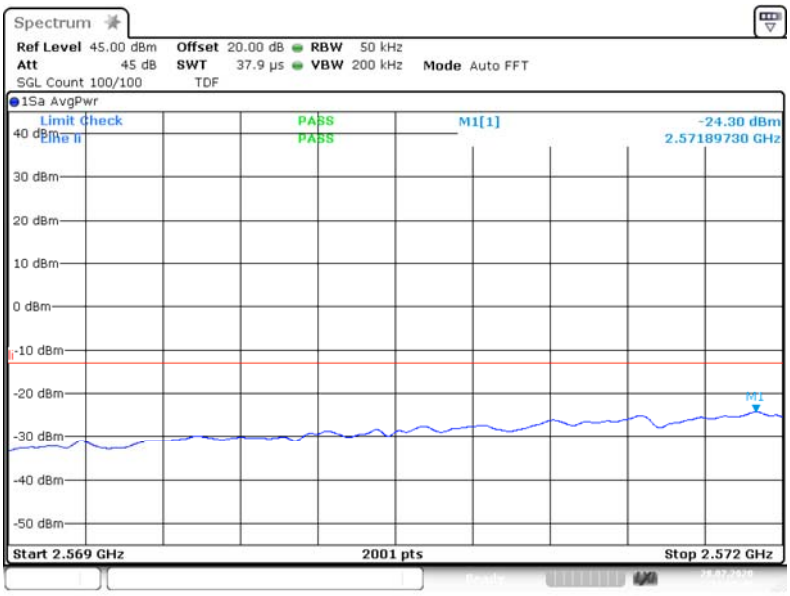
3.6.2 out of band emi BRS_Mid GSM upper 1carrier -0.3 dB 2.6
14G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1



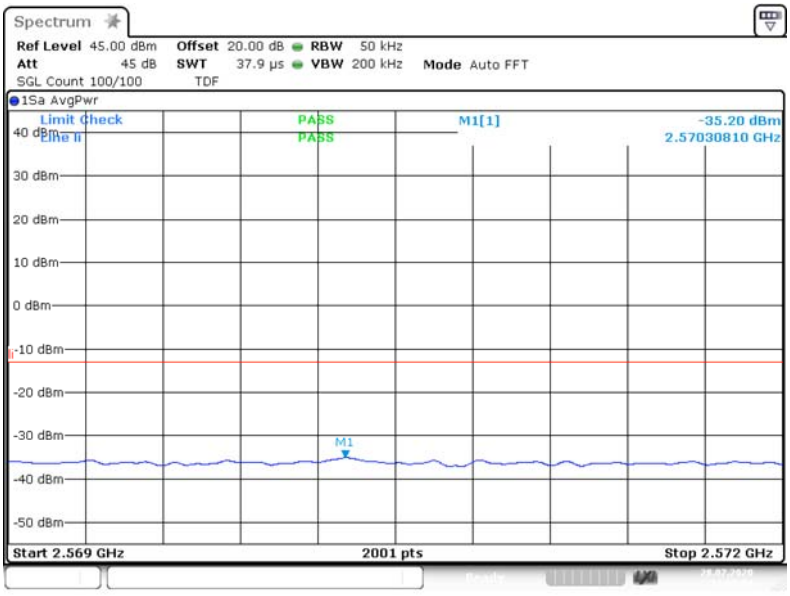
3.6.2 out of band emi BRS_Mid GSM upper 1carrier +3.0 dB 2.6
14G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



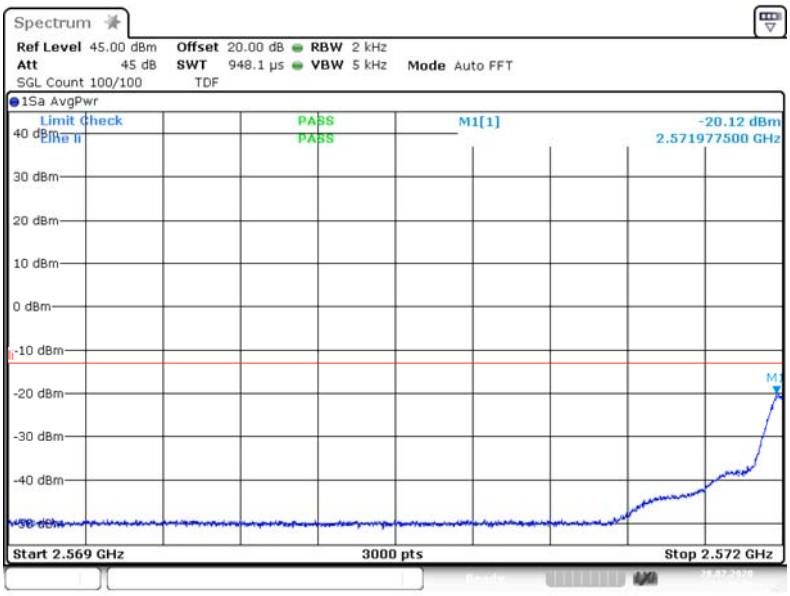
3.6.2 out of band emi BRS_Mid AWGN lower 1carrier -0.3 dB 2.
569G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1



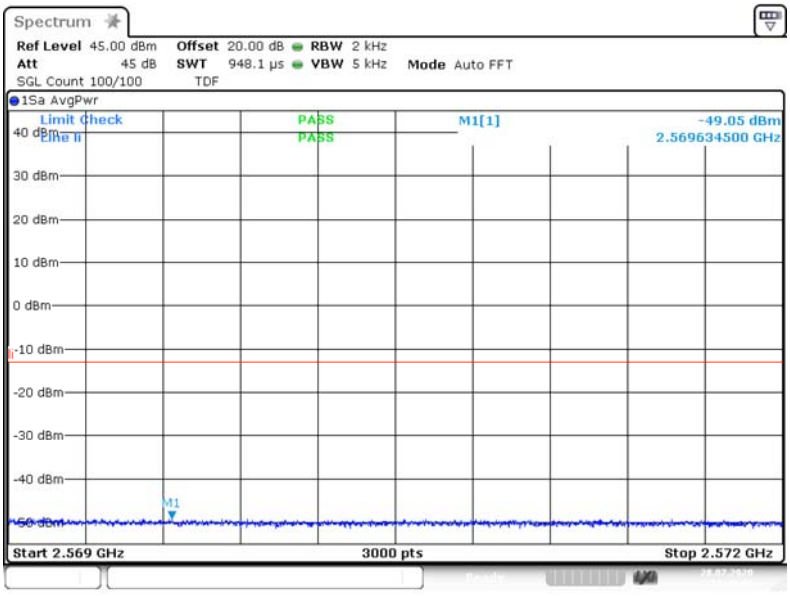
3.6.2 out of band emi BRS_Mid AWGN lower 1carrier +3.0 dB 2.
569G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



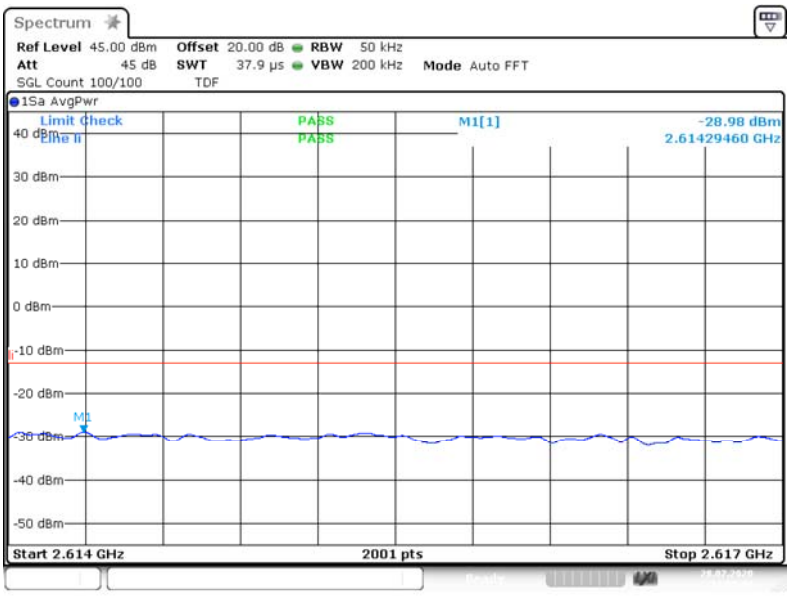
3.6.2 out of band emi BRS_Mid GSM lower lcarrier -0.3 dB 2.5
69G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1



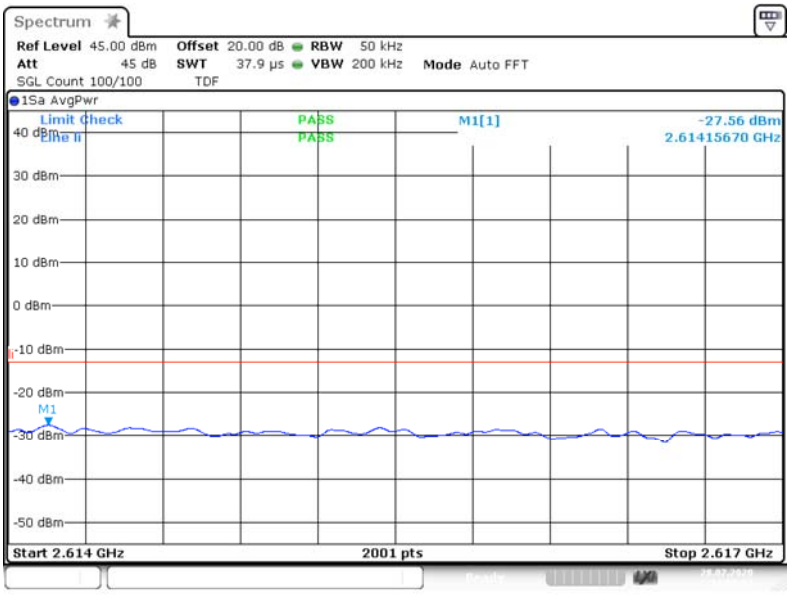
3.6.2 out of band emi BRS_Mid GSM lower lcarrier +3.0 dB 2.5
69G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



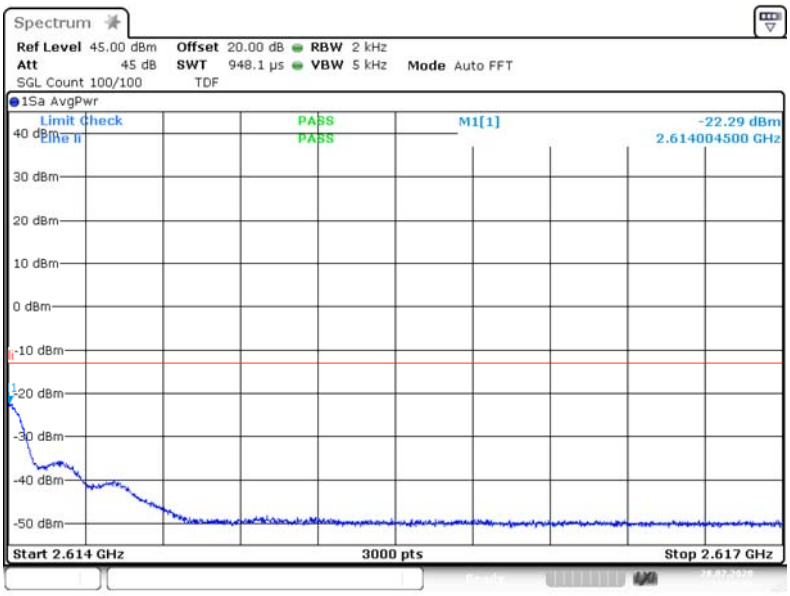
3.6.2 out of band emi BRS_Mid AWGN upper 2carriers -0.3 dB 2
.614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2



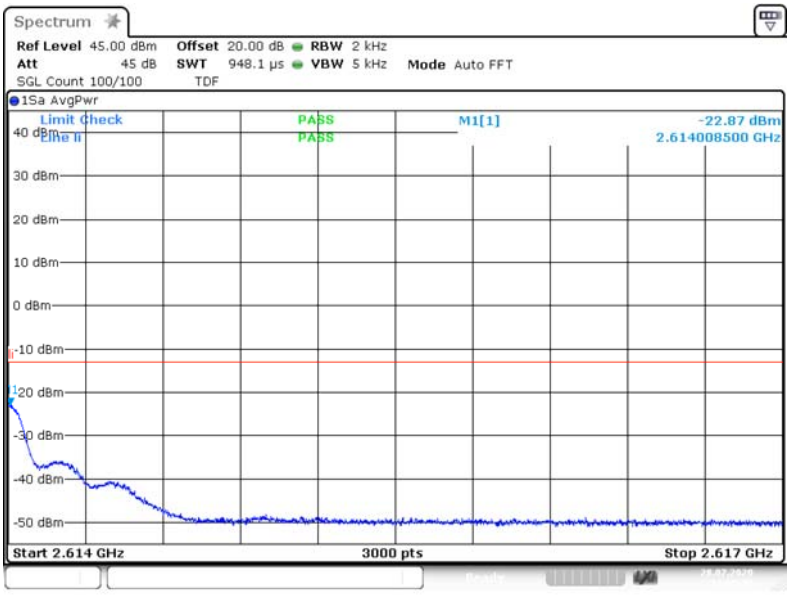
3.6.2 out of band emi BRS_Mid AWGN upper 2carriers +3.0 dB 2
.614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



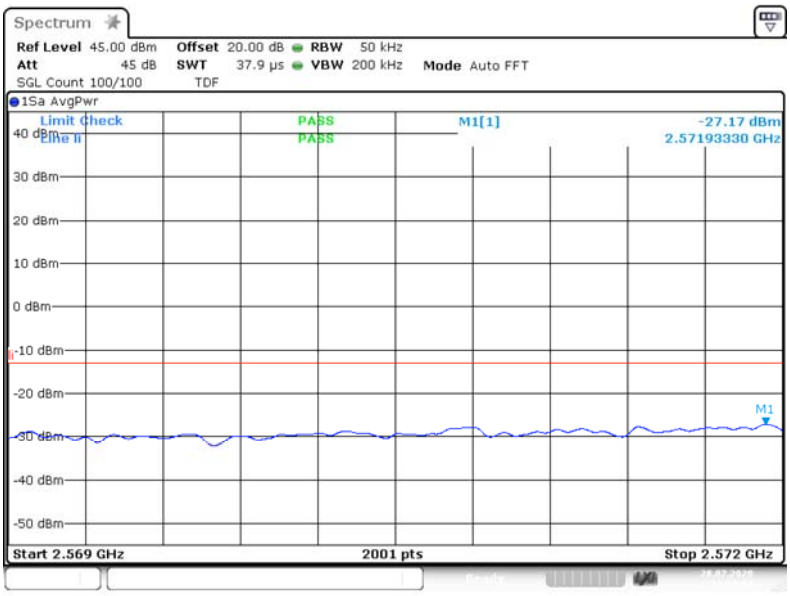
3.6.2 out of band emi BRS_Mid GSM upper 2carriers -0.3 dB 2.
614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2



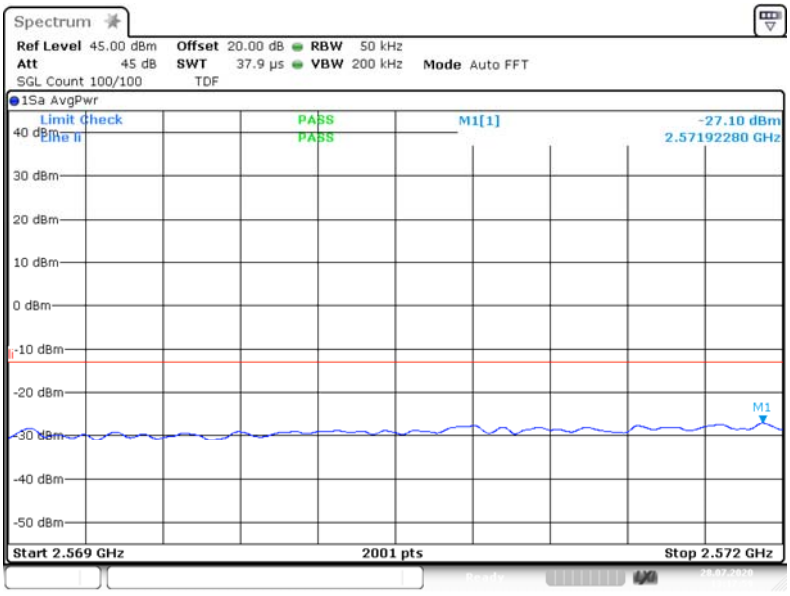
3.6.2 out of band emi BRS_Mid GSM upper 2carriers +3.0 dB 2.
614G 2.617G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



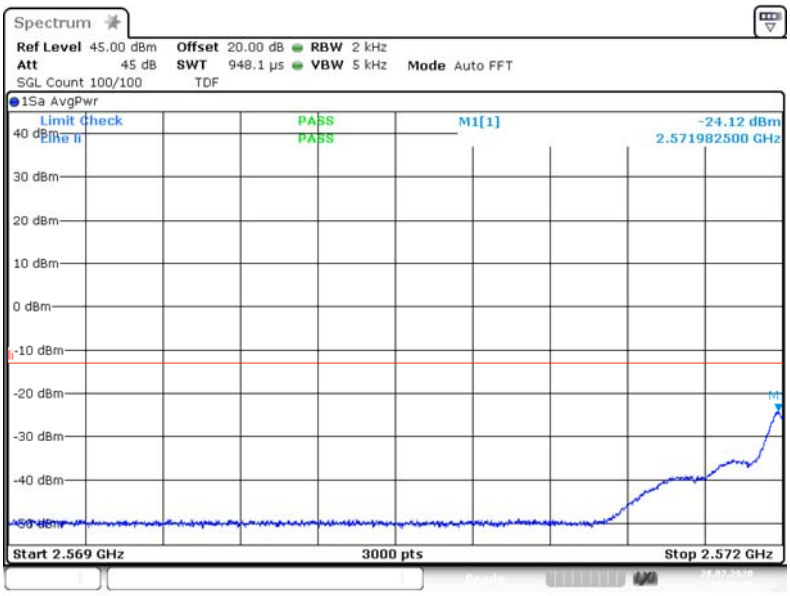
3.6.2 out of band emi BRS_Mid AWGN lower 2carriers -0.3 dB 2
.569G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2



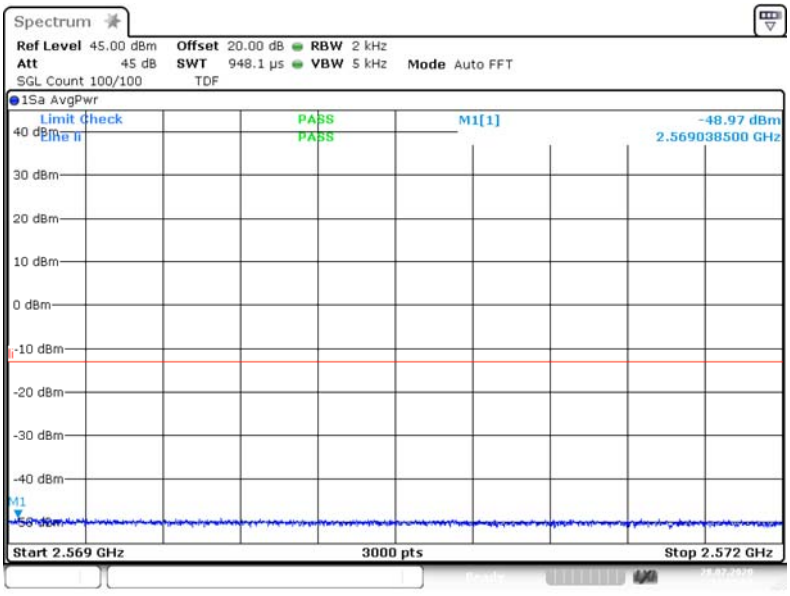
3.6.2 out of band emi BRS_Mid AWGN lower 2carriers +3.0 dB 2
.569G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



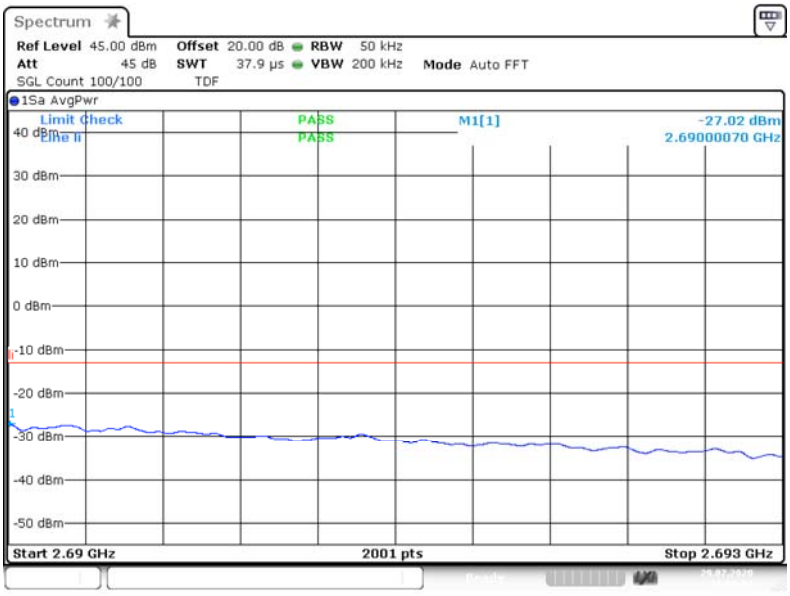
3.6.2 out of band emi BRS_Mid GSM lower 2carriers -0.3 dB 2.
569G 2.572G

Band: BRS MBS; Frequency: 2.5720 GHz to 2.6140 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2



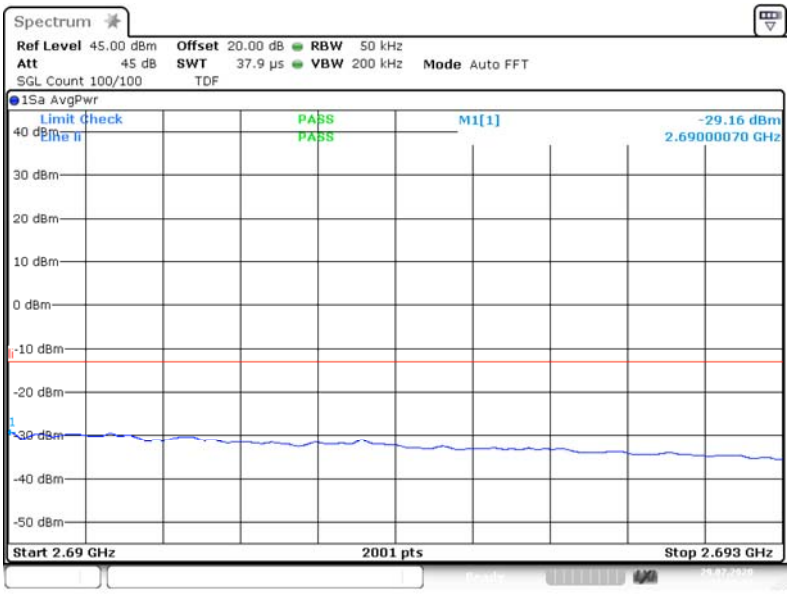
3.6.2 out of band emi BRS_Mid GSM lower 2carriers +3.0 dB 2.
569G 2.572G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



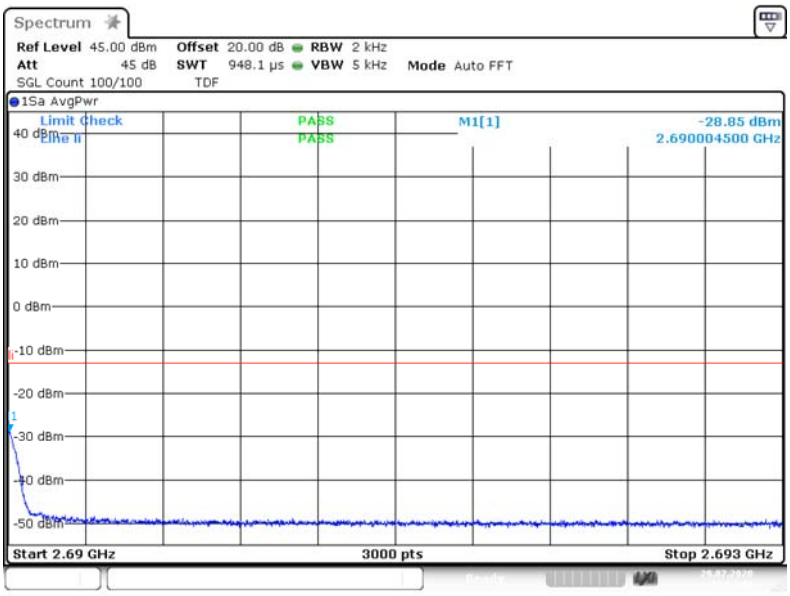
3.6.2 out of band emi BRS_High AWGN upper 1carrier -0.3 dB 2
.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1



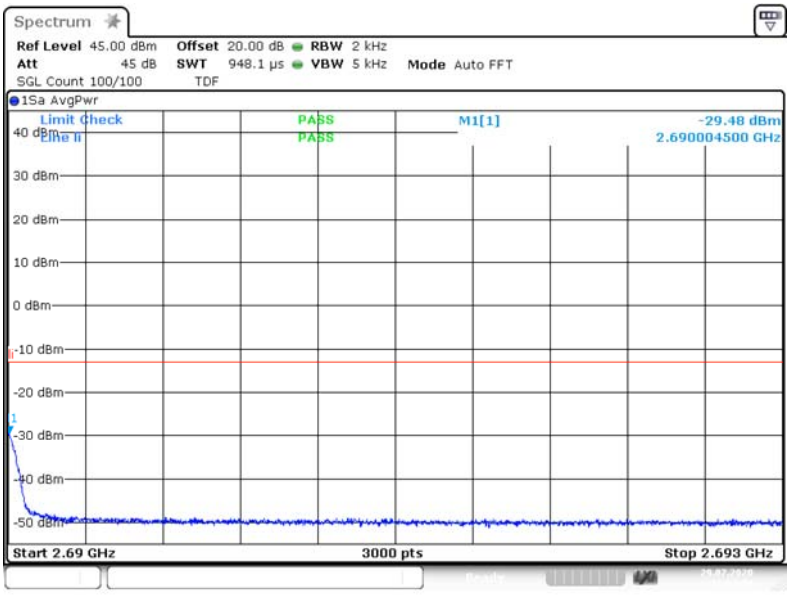
3.6.2 out of band emi BRS_High AWGN upper 1carrier +3.0 dB 2
.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



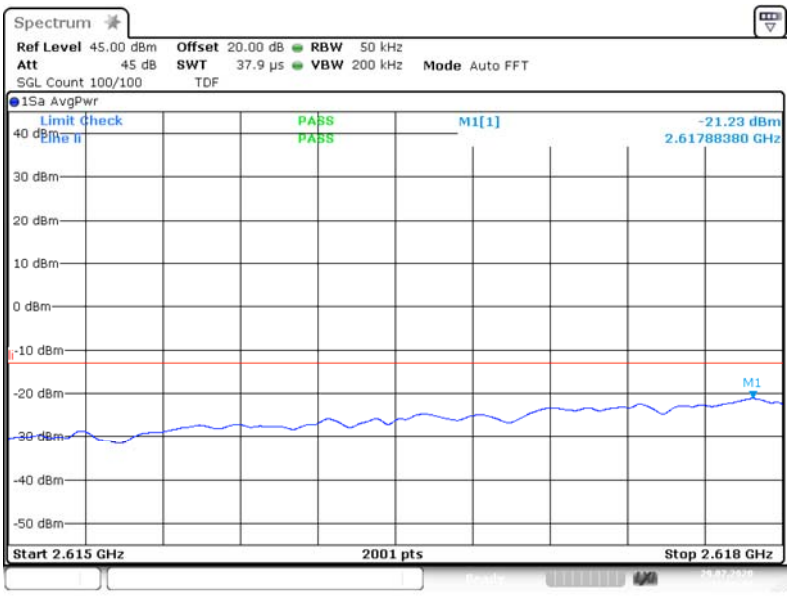
3.6.2 out of band emi BRS_High GSM upper 1carrier -0.3 dB 2.
690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1

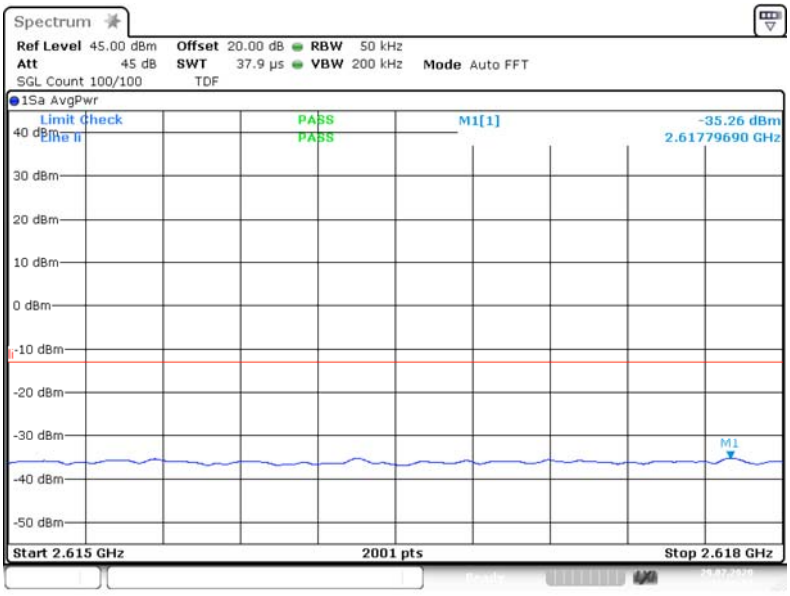


3.6.2 out of band emi BRS_High GSM upper 1carrier +3.0 dB 2.
690G 2.693G

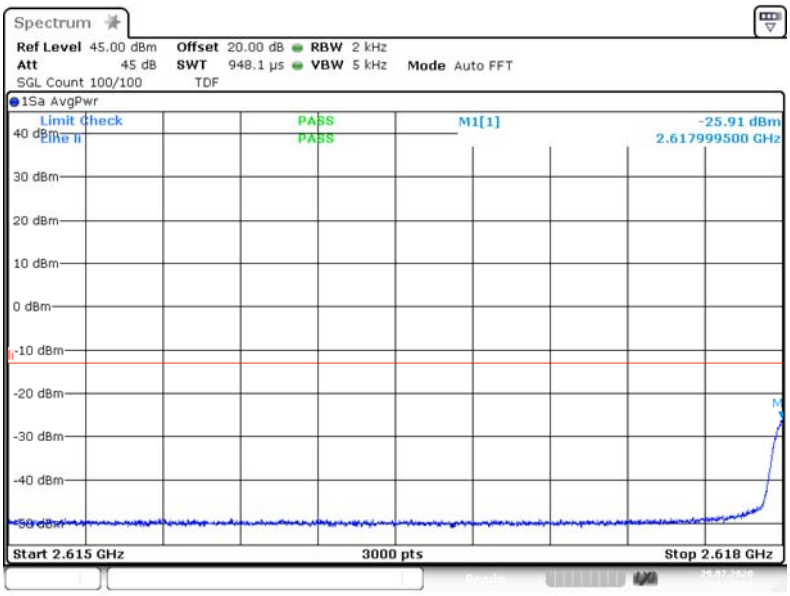
Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 1



Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 1

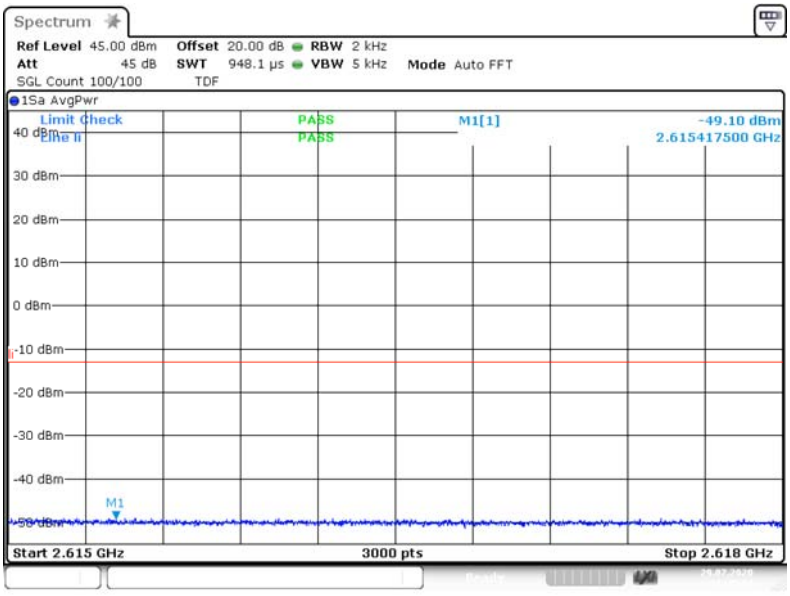


Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 1



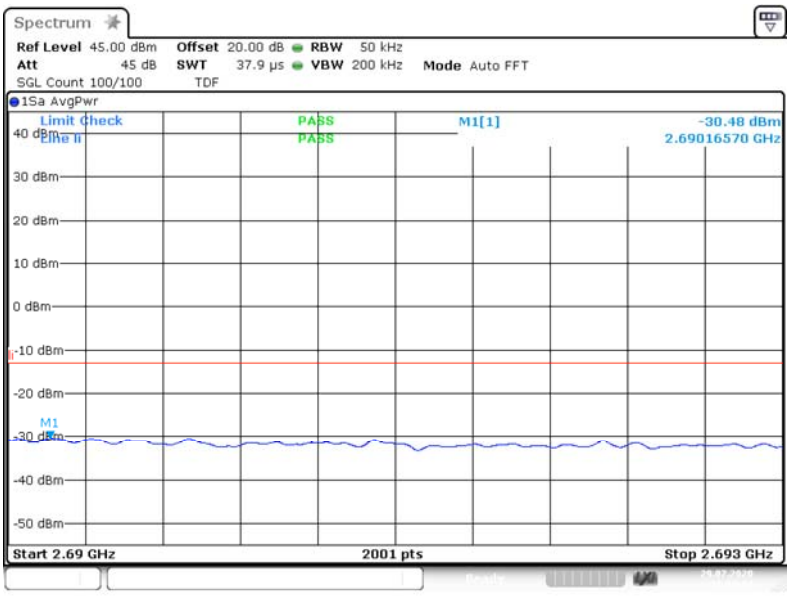
3.6.2 out of band emi BRS_High GSM lower 1carrier -0.3 dB 2.
615G 2.618G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 1



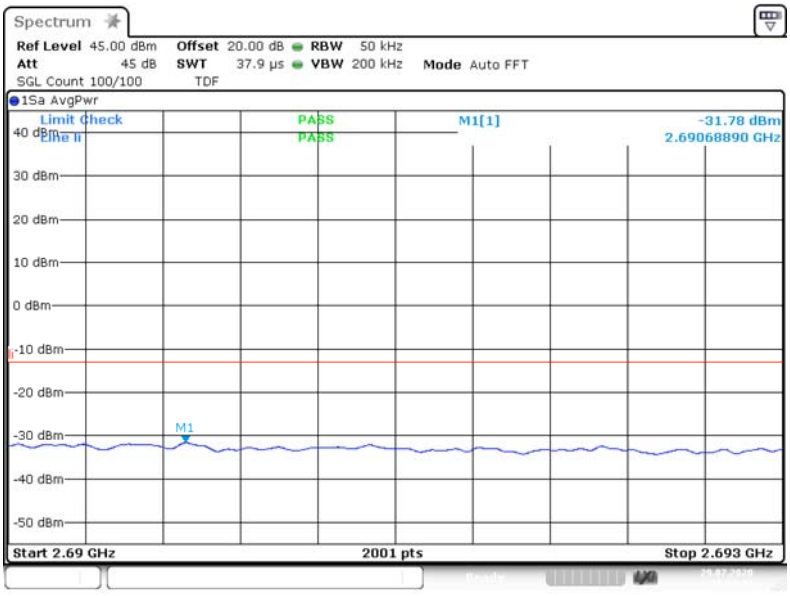
3.6.2 out of band emi BRS_High GSM lower 1carrier +3.0 dB 2.
615G 2.618G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



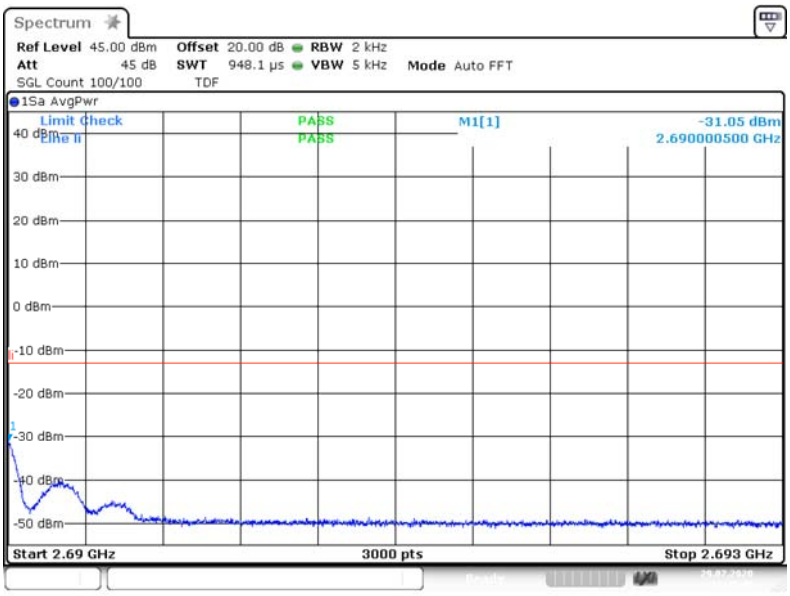
3.6.2 out of band emi BRS_High AWGN upper 2carriers -0.3 dB
2.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2



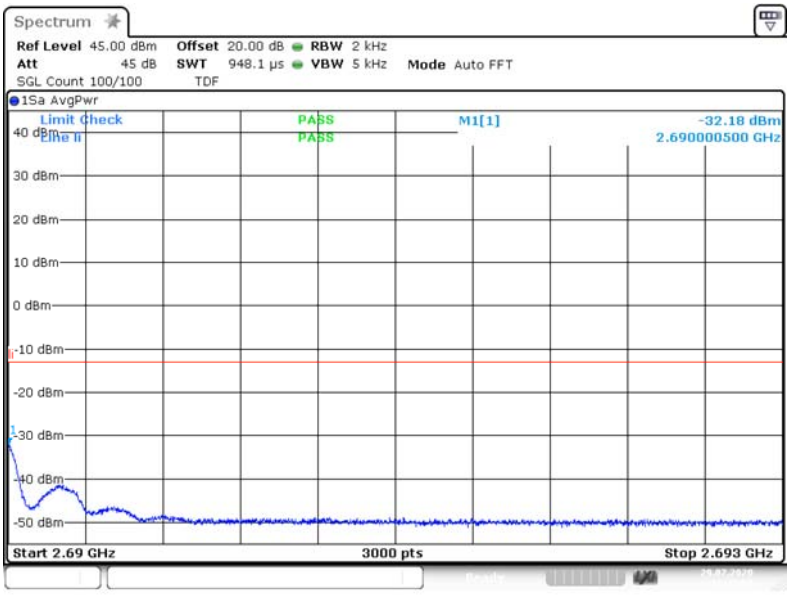
3.6.2 out of band emi BRS_High AWGN upper 2carriers +3.0 dB
2.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



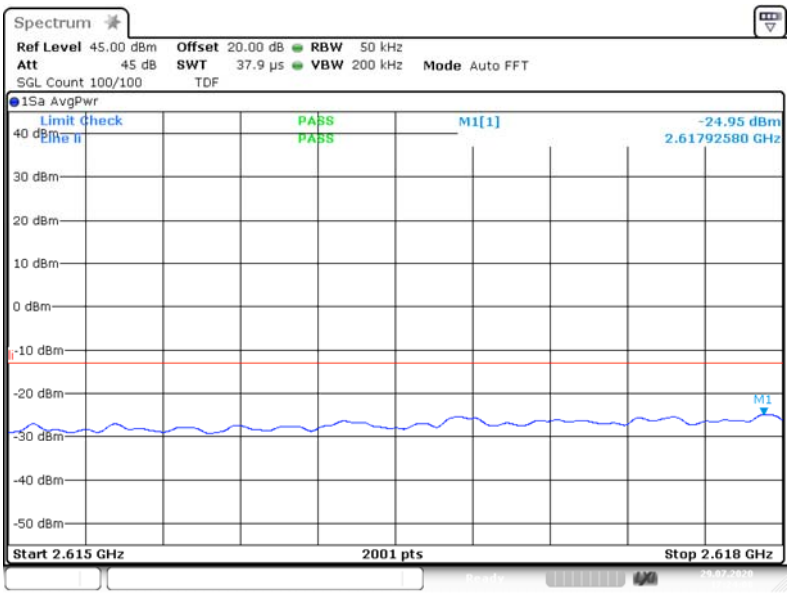
3.6.2 out of band emi BRS_High GSM upper 2carriers -0.3 dB 2
.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: upper; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2



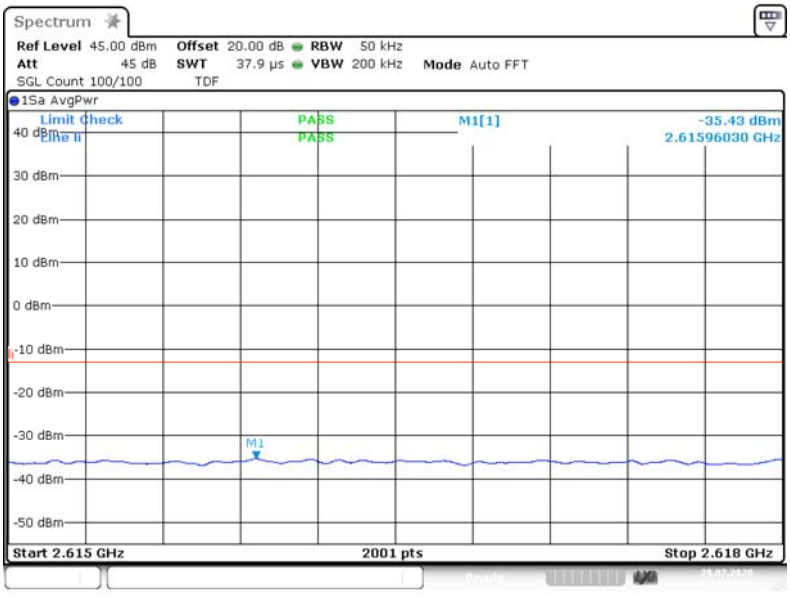
3.6.2 out of band emi BRS_High GSM upper 2carriers +3.0 dB 2
.690G 2.693G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input Power = 0.3 dB < AGC; Number of signals 2



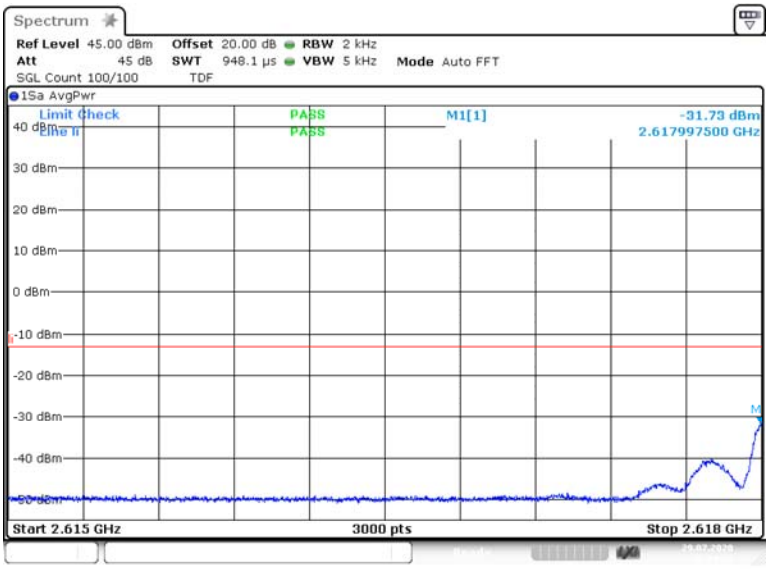
3.6.2 out of band emi BRS_High AWGN lower 2carriers -0.3 dB
2.615G 2.618G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input Power = 3 dB > AGC; Number of signals 2



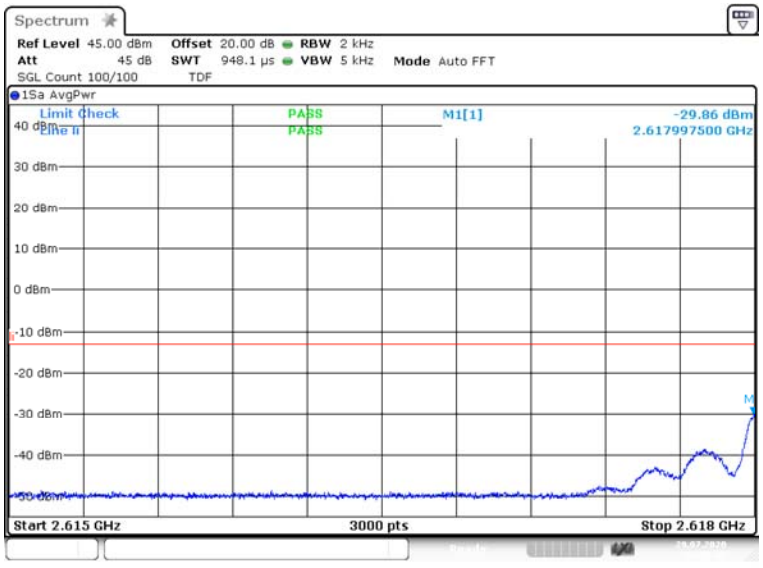
3.6.2 out of band emi BRS_High AWGN lower 2carriers +3.0 dB
2.615G 2.618G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: GSM; Input Power = 0.3 dB < AGC; Number of signals 2



3.6.2 out of band emi BRS_High GSM lower 2carriers -0.3 dB 2
.615G 2.618G

Band: BRS UBS; Frequency: 2.6180 GHz to 2.6900 GHz; Band Edge: lower; Mod: GSM; Input Power = 3 dB > AGC; Number of signals 2



3.6.2 out of band emi BRS_High GSM lower 2carriers +3.0 dB 2
.615G 2.618G

4.5.5 TEST EQUIPMENT USED

- Conducted

4.6 OUT-OF-BAND REJECTION

Standard FCC Part 27

The test was performed according to:
ANSI C63.26; KDB 935210 D05

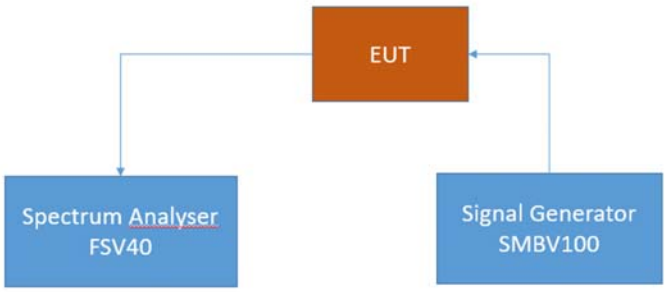
Test date: .2020-07-28 to 2020-07-30

Environmental conditions: 25 ° C; 40 % r. F.

Test engineer: Thomas Hufnagel

4.6.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the out-of-band rejection test case for industrial signal boosters.
The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; Out-of-band rejection

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.6.2 TEST REQUIREMENTS/LIMITS

Abstract RSS-131 from ISED:

RSS-131; 5.2.1 Out-of-band rejection

The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer.

4.6.3 TEST PROTOCOL

Band 41 BRS (LBS), downlink				
Highest Power Frequency [MHz]	**Output Power [dBm]**	**Lower Highest Power -20 dB Frequency [MHz]**	**Upper Highest Power -20 dB Frequency [MHz]**	**20 dB Bandwidth [MHz]**
2545.23	24.07	2492.4900	2571.5820	72.0920

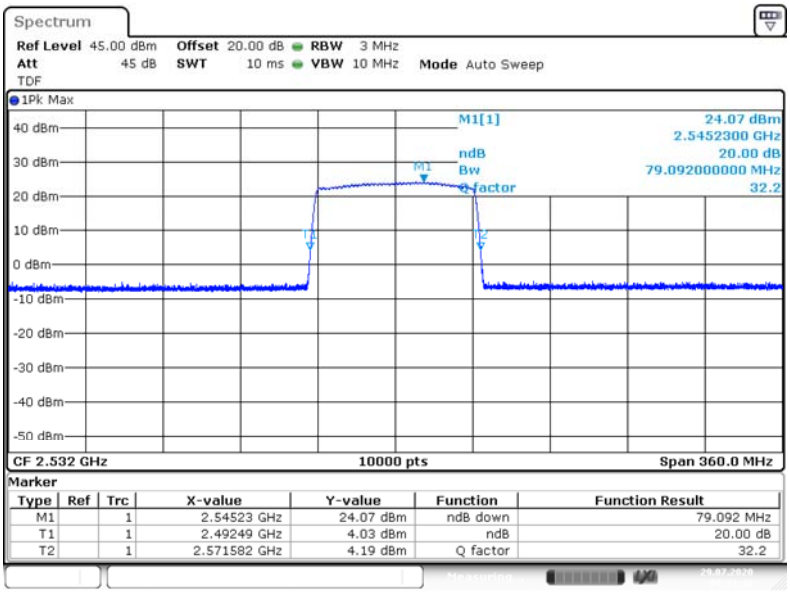
Band 41 BRS (MBS), downlink				
Highest Power Frequency [MHz]	**Output Power [dBm]**	**Lower Highest Power -20 dB Frequency [MHz]**	**Upper Highest Power -20 dB Frequency [MHz]**	**20 dB Bandwidth [MHz]**
2582.00	24.76	2570.2890	2615.7120	45.4230

Band 41 BRS (UBS), downlink				
Highest Power Frequency [MHz]	**Output Power [dBm]**	**Lower Highest Power -20 dB Frequency [MHz]**	**Upper Highest Power -20 dB Frequency [MHz]**	**20 dB Bandwidth [MHz]**
2641.00	22.06	2614.2740	2693.4740	79.2000

Remark: Please see next sub-clause for the measurement plot.

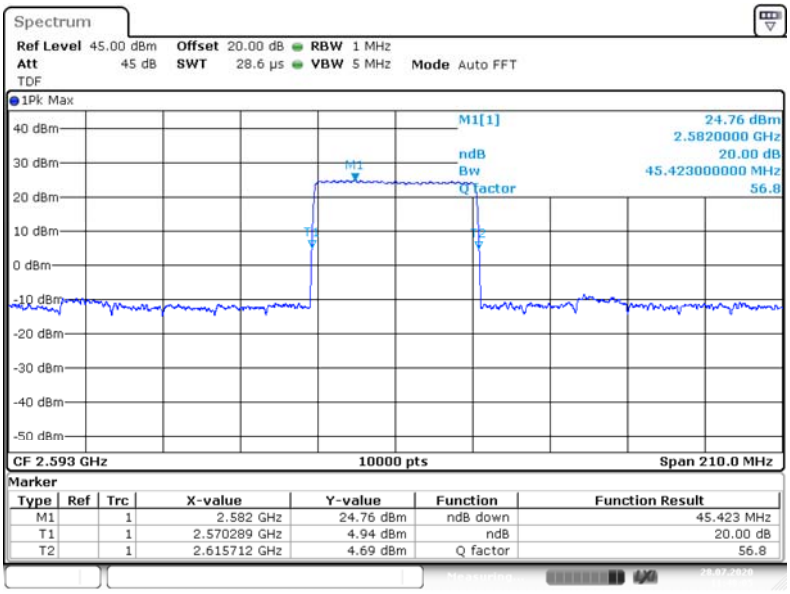
4.6.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = BRS LBS, Direction = RF downlink



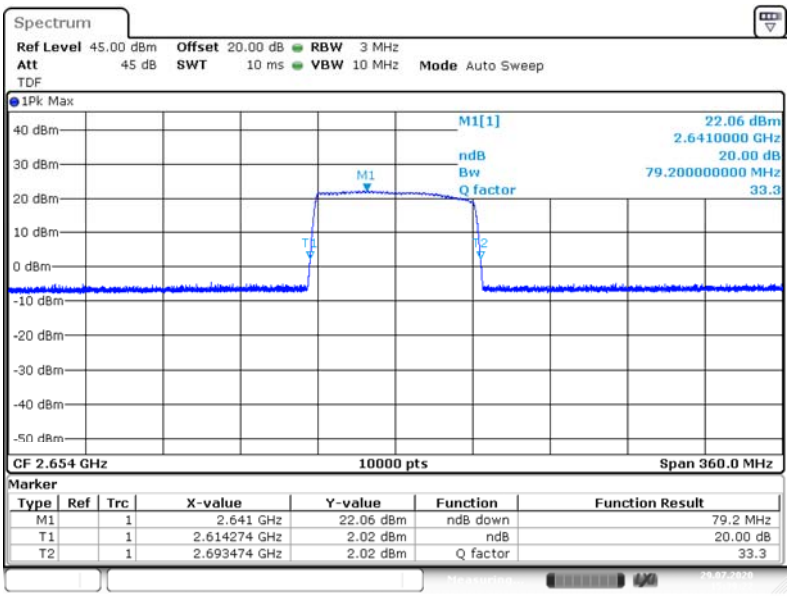
3.3 Out of band rejection BRS_Low 2.53200G
_20dB

Frequency Band = BRS MBS, Direction = RF downlink



3.3 Out of band rejection BRS_Mid 2.59300G
_20dB

Frequency Band = BRS UBS, Direction = RF downlink



3.3 Out of band rejection BRS_High 2.65400G
_20dB

4.6.5 TEST EQUIPMENT USED

- Conducted

4.7 FIELD STRENGTH OF SPURIOUS RADIATION

Standard FCC Part 27, § 24.53

The test was performed according to:
ANSI C63.26

Test date: 2020-09-09

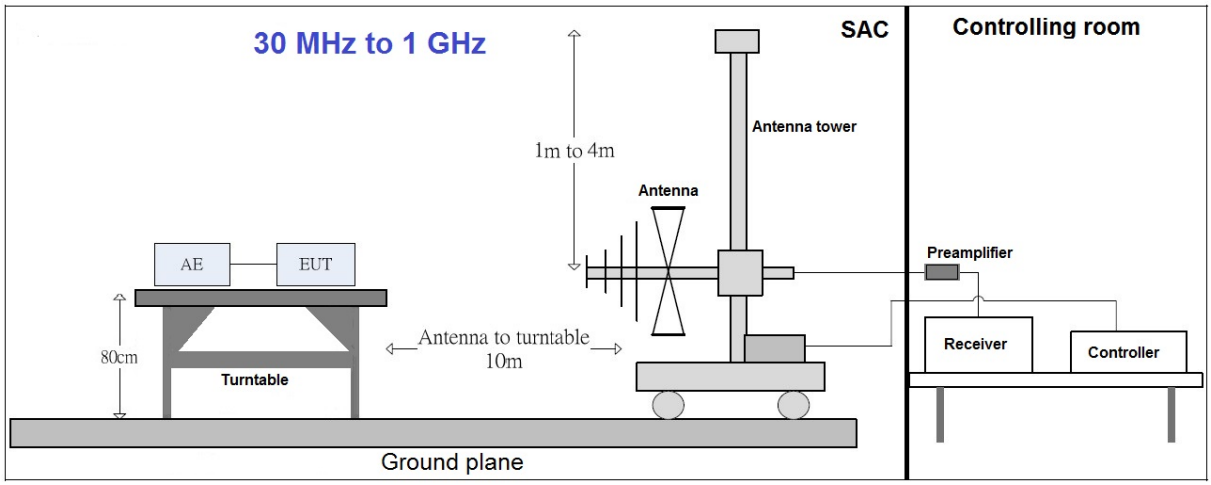
Environmental conditions: 23 ° C; 46 % r. F.

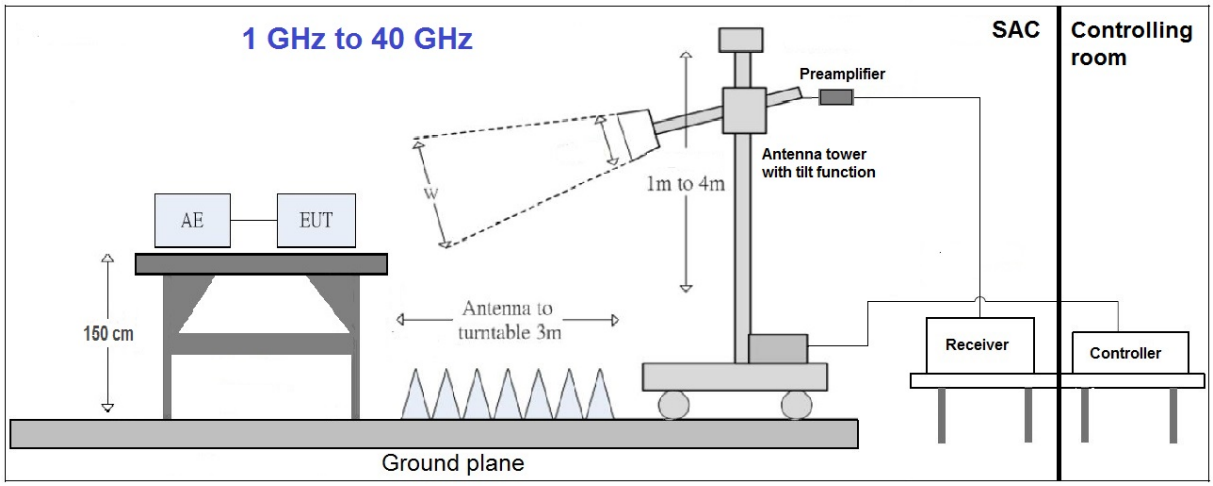
Test engineer: Thomas Hufnagel

4.7.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable radiated spurious emission measurements per § 2.1053

The EUT was connected to the test setup according to the following diagram:





The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.5 x 1.5 m² in the semi-anechoic chamber, 0.8 meter above the ground or floor-standing arrangement shall be placed on the horizontal ground reference plane.. The influence of the EUT support table that is used between 30–1000 MHz was evaluated. For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. The highest emissions between 30 MHz to 1000 MHz were analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions.

The measurement procedure is implemented into the EMI test software BAT EMC from NEXIO. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered by a DC power source. ?

1. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 10 m
- Detector: Peak-Maxhold/RMS (FFT-based)
- Frequency range: 30 – 1000 MHz
- Frequency steps: 30 kHz
- IF–Bandwidth: 120 kHz
- Measuring time/Frequency step: 5 ms
- Turntable angle range: –180° to 180°
- Turntable step size: 30°
- Height variation range: 1 – 4 m
- Height variation step size: 1 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by ± 45° around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 100 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak – Maxhold; RMS
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: ± 30 ° around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector
With the settings determined in step 3, the final measurement will be performed:
EMI receiver settings for step 4:
- Detector: Quasi-Peak (< 1 GHz); RMS; Peak
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz
The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
Step 1:
The Equipment Under Test (EUT) was set up on a non-conductive support at 1.5 m height in the semi-anechoic chamber. Absorbers are placed around and between the turn table and the antenna tower.
All steps were performed with one height (1.5 m) of the receiving antenna only.
The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 30 °.
The turn table step size (azimuth angle) for the preliminary measurement is 15 °.
Step 2:
The maximum RFI field strength was determined during the measurement by rotating the turntable (±180 degrees) and varying the height of the receive antenna (h = 1 ... 4 m) with a additional tilt function of the antenna.The turn table azimuth will slowly vary by ± 15°.
EMI receiver settings (for all steps):
- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Step 3:
Spectrum analyser settings for step 3:
- Detector: Peak/Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

4.7.2 TEST REQUIREMENTS/LIMITS

Abstract from FCC Part § 2.1053:

FCC Part 2.1053; Measurement required: Field strength of spurious radiation:

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate.

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§27.53 – Emission limits

Abstract § 27.53 FCC:

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(1) Prior to the transition, and thereafter, solely within the MBS, for analog operations with an EIRP in excess of −9 dBW, the signal shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Abstract RSS-199 from ISED:

RSS-199; 4.5 Transmitter unwanted emissions

In the 1 MHz band immediately outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

Equipment shall comply with the following unwanted emission limits:

(a) for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least 43 + 10 log10 p.

(i) 40 + 10 log10 p from the channel edges to 5 MHz away
(ii) 43 + 10 log10 p between 5 MHz and X MHz from the channel edges, and
(iii) 55 + 10 log10 p at X MHz and beyond from the channel edges.

In addition, the attenuation shall not be less than 43 + 10 log10 p on all frequencies between 2490.5 MHz and 2496 MHz, and 55 + 10 log10 p at or below 2490.5 MHz. (b) for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

4.7.3 TEST PROTOCOL

30 MHz to 1 GHz:

Band 41 BRS (LBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
74,83	-55,3	2.1	PEAK	120	-13.0	
273,49	-53,9	2.1	PEAK	120	-13.0	
600,07	-68,1	2.1	PEAK	120	-13.0	
75,04	-60,0	2.1	PEAK	120	-13.0	
272,08	-56,8	2.1	PEAK	120	-13.0	
600,01	-62,9	2.1	PEAK	120	-13.0	

1 GHz to 18 GHz:

Band 41 BRS (LBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
2496,3	-25,4	2.1	PEAK	1000	-13.0	
2532,0	-35,2	2.1	PEAK	1000	-13.0	
2567,7	-37,5	2.1	PEAK	1000	-13.0	
2496,25	-30,2	2.1	PEAK	1000	-13.0	
2532,0	-27,5	2.1	PEAK	1000	-13.0	
2567,9	-32,0	2.1	PEAK	1000	-13.0	

18 GHz to 27 GHz:

Band 41 BRS (LBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
20626.5	-52,1	2.1	PEAK	1000	-13.0	
20623.5	-52,4	2.1	PEAK	1000	-13.0	

30 MHz to 1 GHz:

Band 41 BRS (MBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
36.13	-69.2	0.1	PEAK	120	-13.0	56.2
75.07	-55.2	0.1	PEAK	120	-13.0	42.2
274.15	-53.6	0.1	PEAK	120	-13.0	40.6
600.01	-63.3	0.1	PEAK	120	-13.0	50.3

1 GHz to 18 GHz:

Band 41 BRS (MBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
2572.2	-37.7	0.1	PEAK	1000	-13.0	24.7
2592.9	-39.4	0.1	PEAK	1000	-13.0	26.4
2613.9	-37.1	0.1	PEAK	1000	-13.0	24.1
2572.2	-43.4	0.1	PEAK	1000	-13.0	30.4
2592.9	-24.8	0.1	PEAK	1000	-13.0	11.8
2613.9	-34.7	0.1	PEAK	1000	-13.0	21.7

18 GHz to 27 GHz:

Band 41 BRS (MBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
20624.0	-29.4	0.1	PEAK	1000	-13.0	16.4
26752.9	-44.5	0.1	PEAK	1000	-13.0	31.5
20626.0	-52.1	0.1	PEAK	1000	-13.0	39.1
26760.8	-45.1	0.1	PEAK	1000	-13.0	32.1

30 MHz to 1 GHz:

Band 41 BRS (UBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
74,74	-55,7	2.2	PEAK	120	-13.0	42,7
231,28	-59,2	2.2	PEAK	120	-13.0	46,2
271,18	-54,0	2.2	PEAK	120	-13.0	41,0
599,98	-63,3	2.2	PEAK	120	-13.0	50,3

1 GHz to 18 GHz:

Band 41 BRS (UBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
2618,1	-33,7	2.2	PEAK	1000	-13.0	20,7
2654,1	-31,3	2.2	PEAK	1000	-13.0	18,3
2689,8	-34,9	2.2	PEAK	1000	-13.0	21,9
2618,1	-29,2	2.2	PEAK	1000	-13.0	16,2
2654,1	-28,8	2.2	PEAK	1000	-13.0	15,8
2689,7	-33,9	2.2	PEAK	1000	-13.0	20,9

18 GHz to 27 GHz:

Band 41 BRS (UBS), downlink;						
Spurious Freq. [MHz]	**Spurious Level [dBm]**	**Pin (Sum Level) [dBm]**	**Detector**	**RBW [kHz]**	**Limit [dBm]**	**Margin to Limit [dB]**
20623,3	-52,4	2.2	PEAK	1000	-13.0	39,4
26751,8	-44,7	2.2	PEAK	1000	-13.0	31,7
20625,0	-52,7	2.2	PEAK	1000	-13.0	39,7
26767,7	-45,0	2.2	PEAK	1000	-13.0	32,0

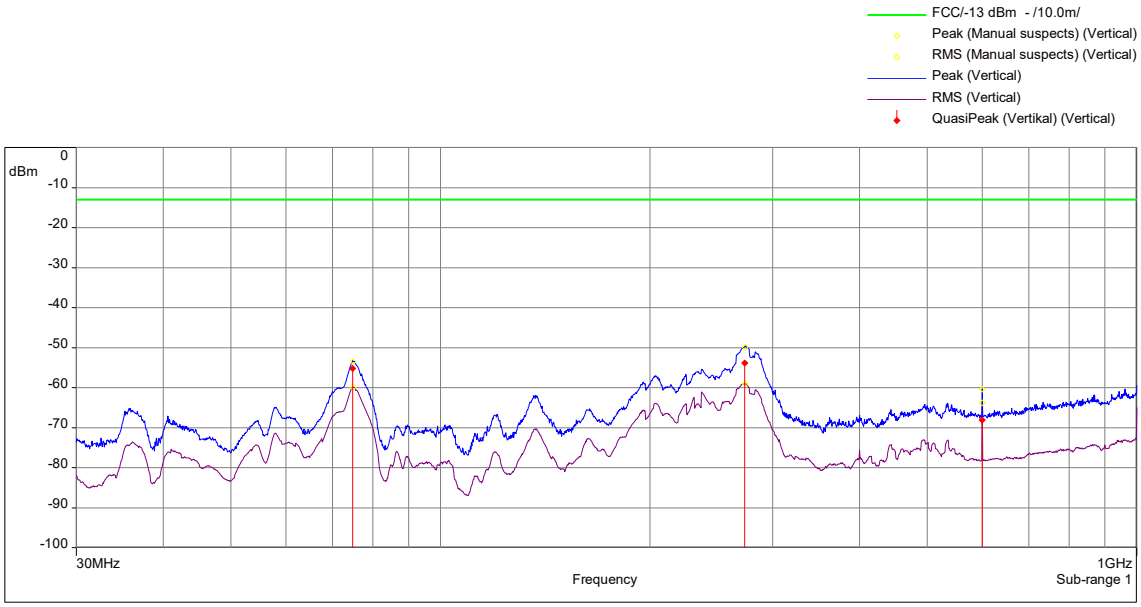
Remarks: Please see next sub-clause for the measurement plot.

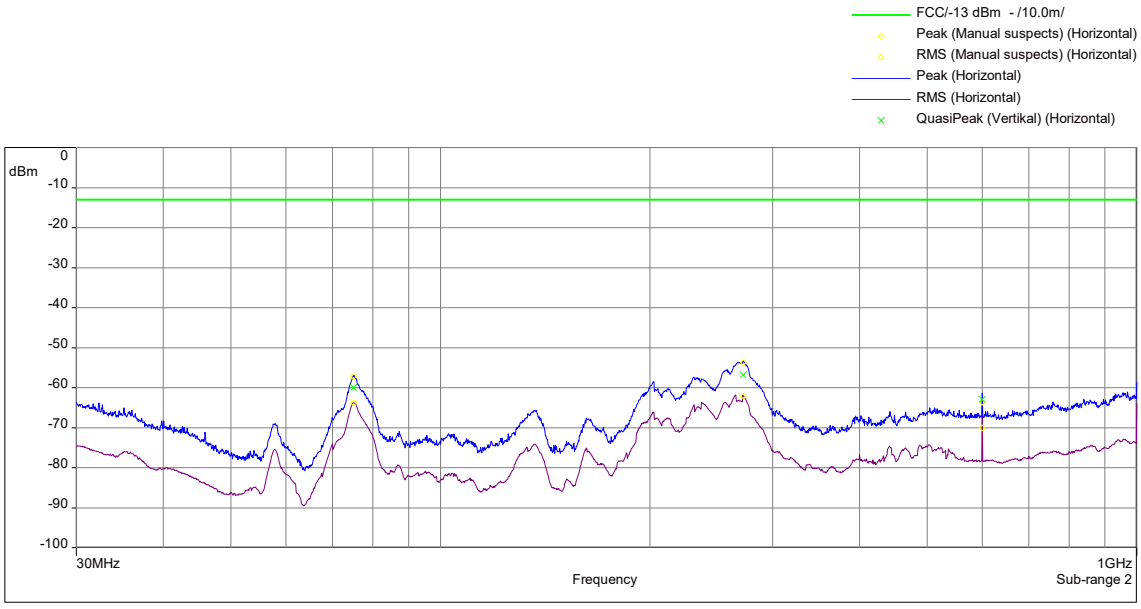
Although ususally a RMS detector is used for measruements in this cases a PEAK detector was used.
The limits are values for use of a RMS detector, but it is so, that the use of a PEAK detector results in readings with higher measured levels. Because the levels with the higher values with PEAK detector are in tolerance, the limits with a RMS detector are definately also in tolerance.

4.7.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

Frequency Band = BRS LBS, Test Frequency = low, Direction = RF downlink

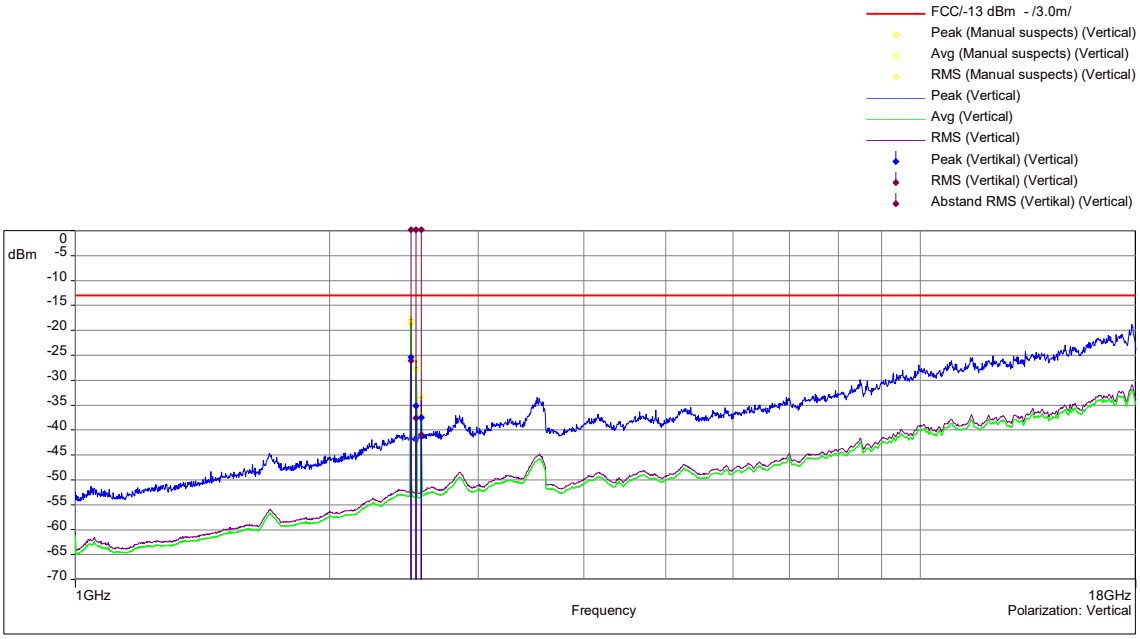
30 MHz - 1 GHz

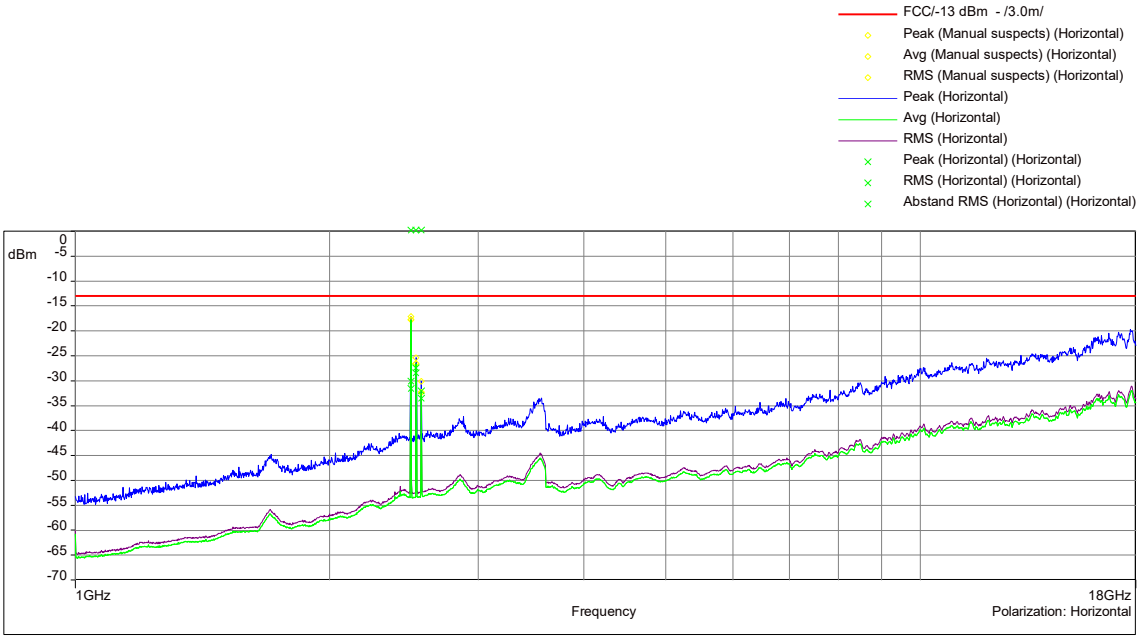




Frequency Band = BRS LBS, Test Frequency = low, Direction = RF downlink

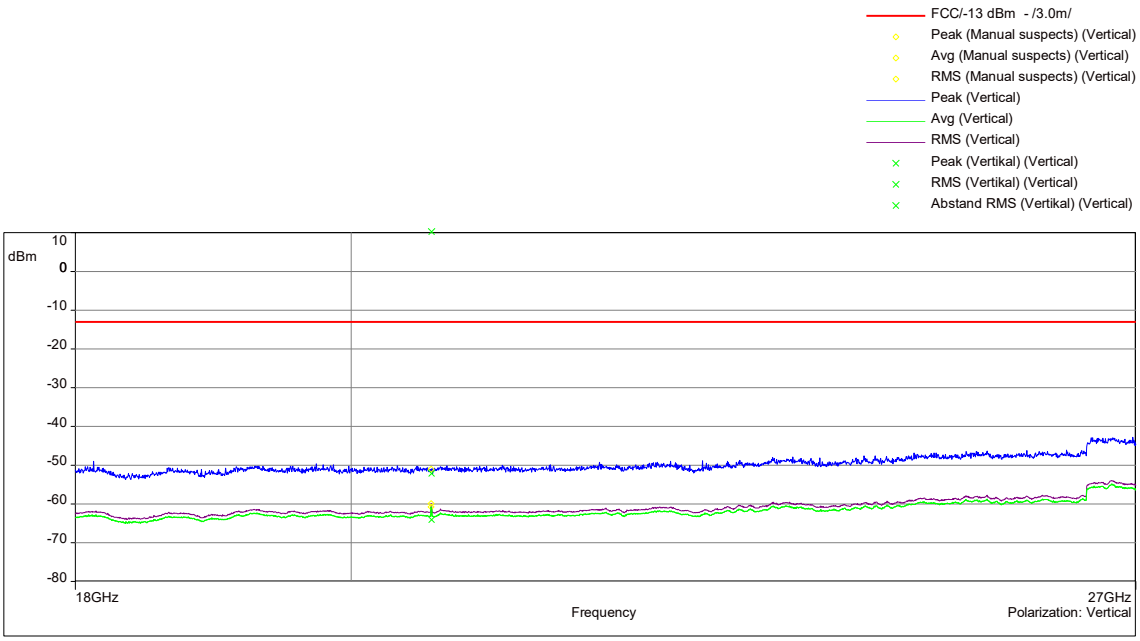
1 GHz - 18 GHz

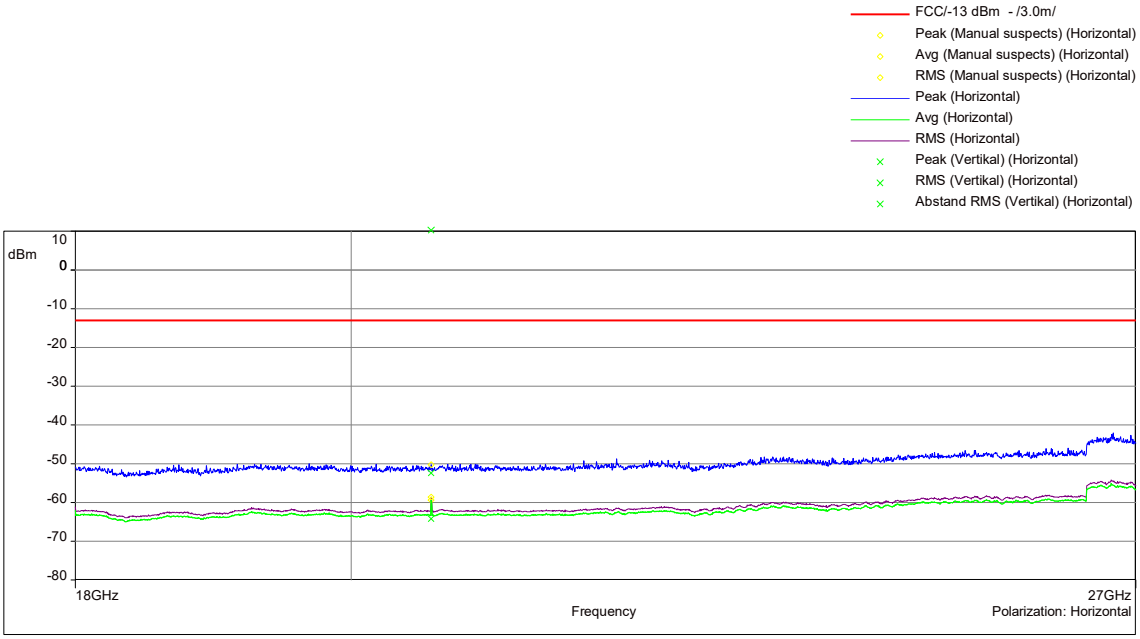




Frequency Band = BRS LBS, Test Frequency = low, Direction = RF downlink

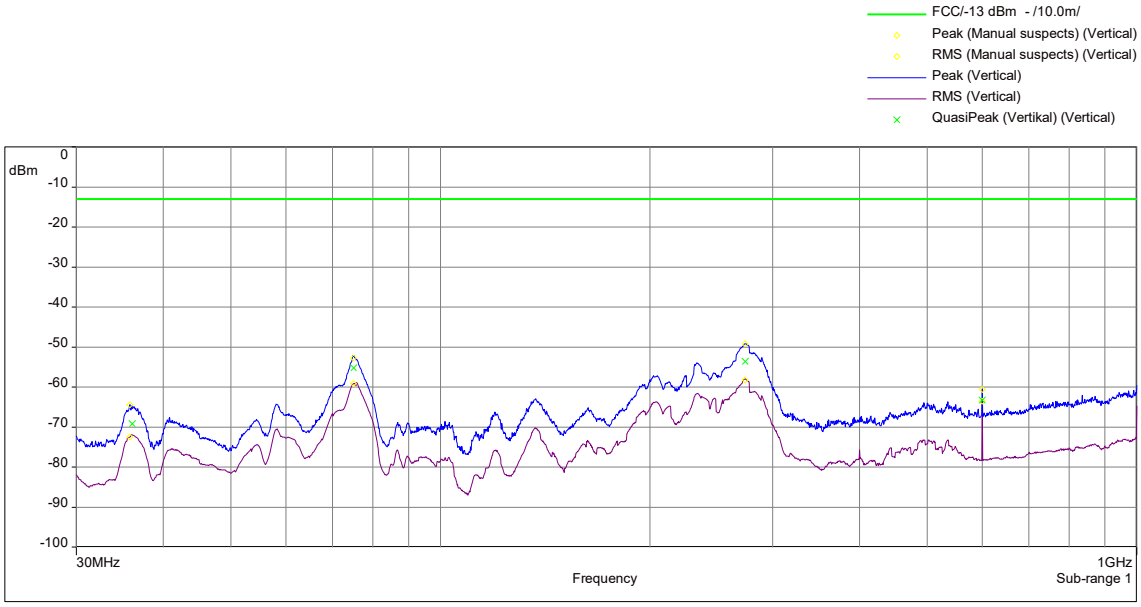
18 GHz - 27 GHz

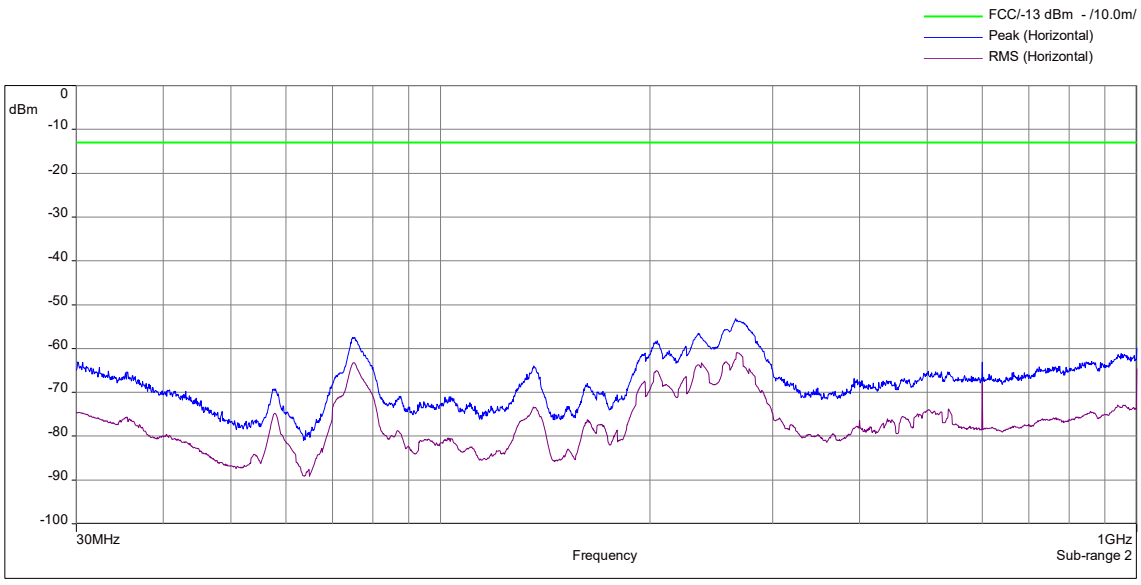




Frequency Band = BRS MBS, Test Frequency = low, Direction = RF downlink

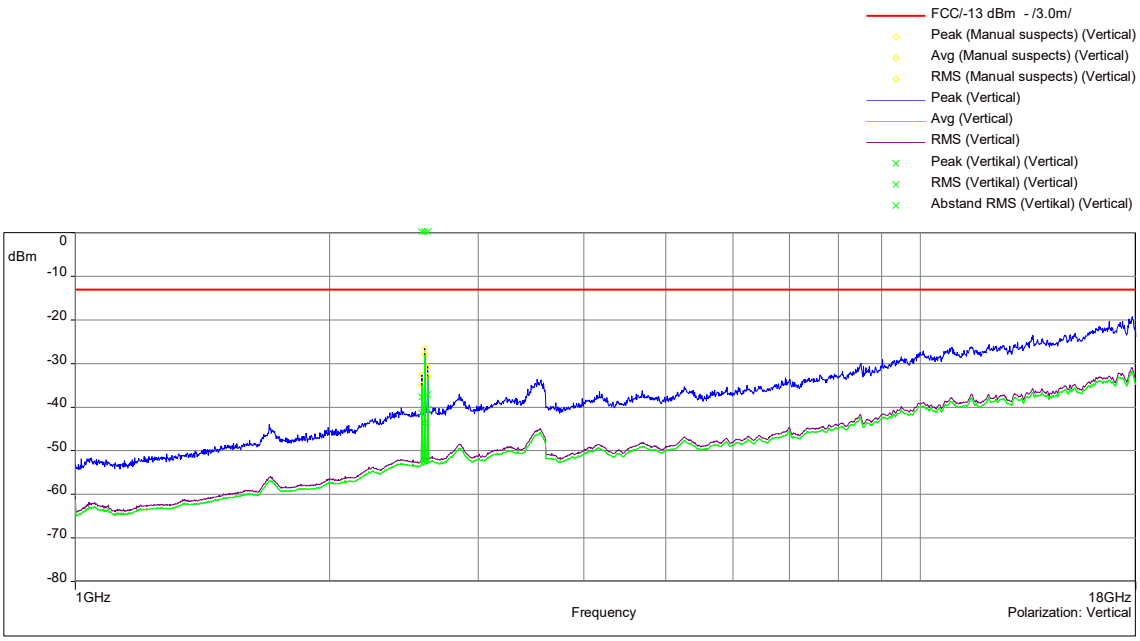
30 MHz - 1 GHz

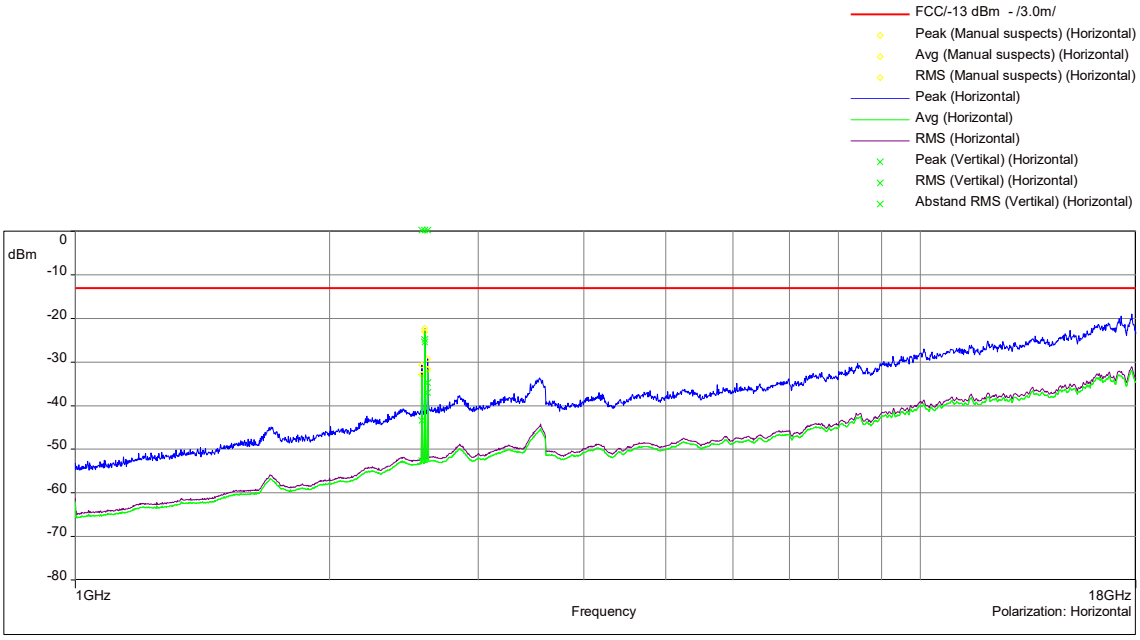




Frequency Band = BRS MBS, Test Frequency = low, Direction = RF downlink

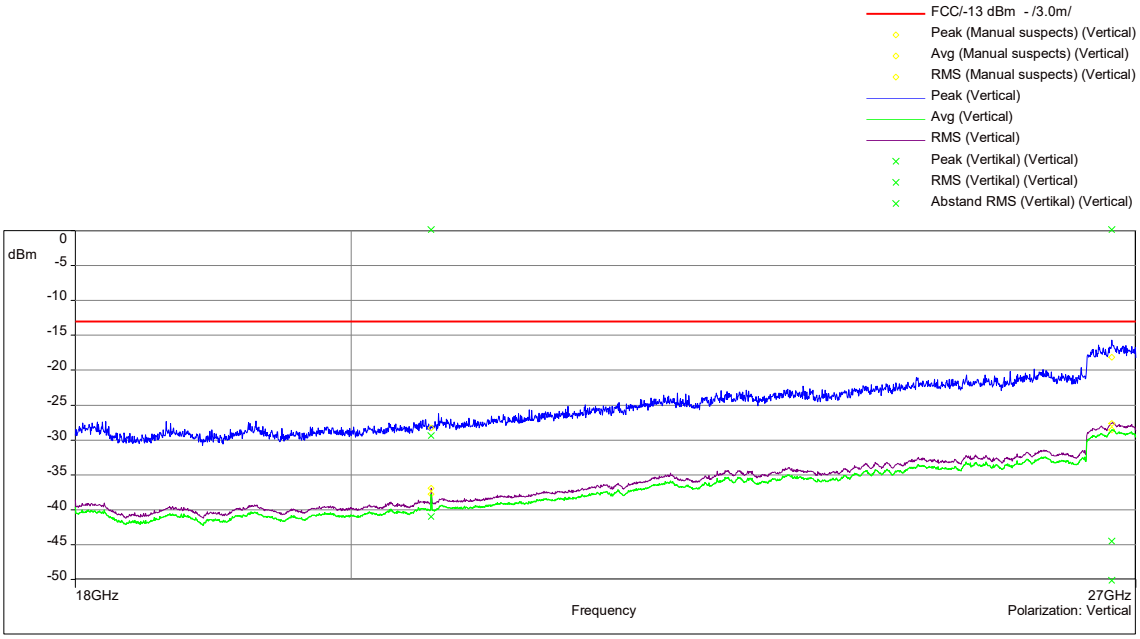
1 GHz - 18 GHz

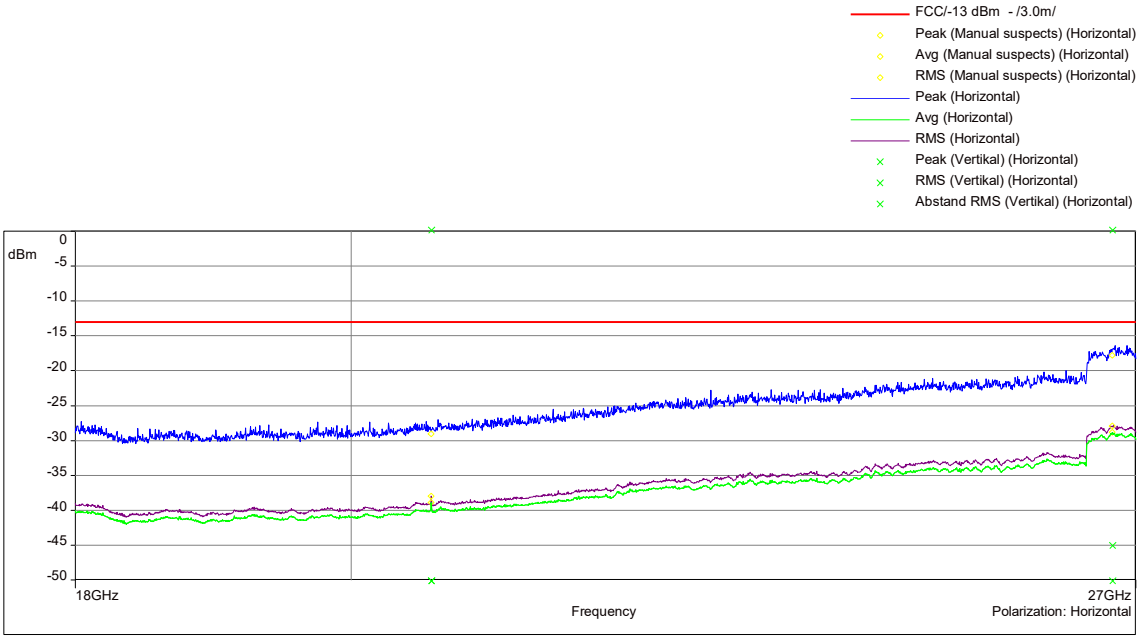




Frequency Band = BRS MBS, Test Frequency = low, Direction = RF downlink

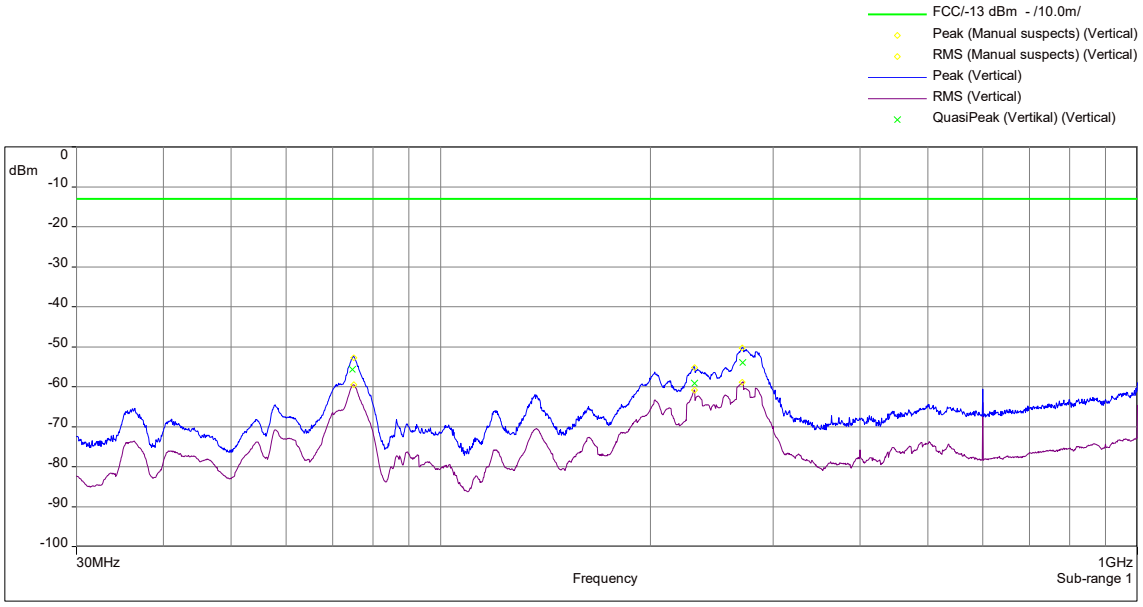
18 GHz - 27 GHz

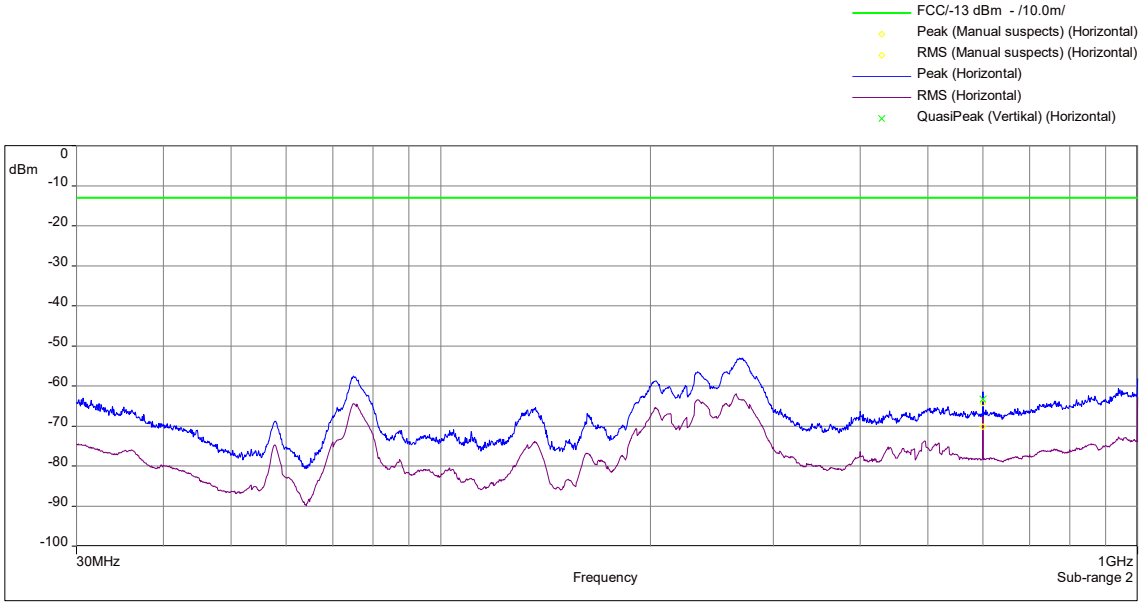




Frequency Band = BRS UBS, Test Frequency = low, Direction = RF downlink

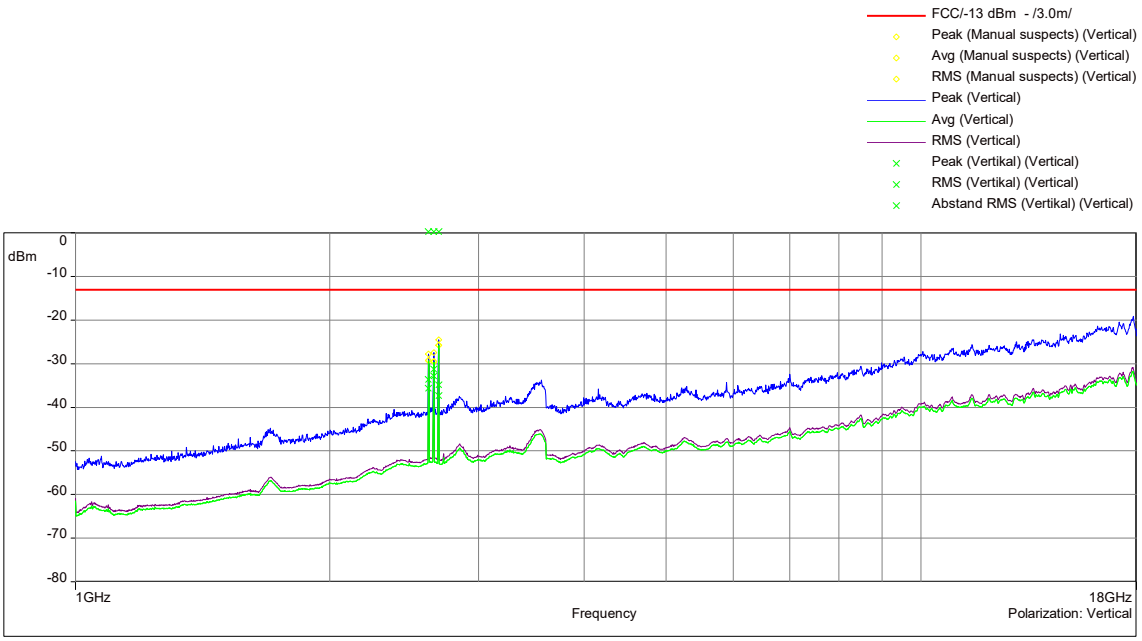
30 MHz - 1 GHz

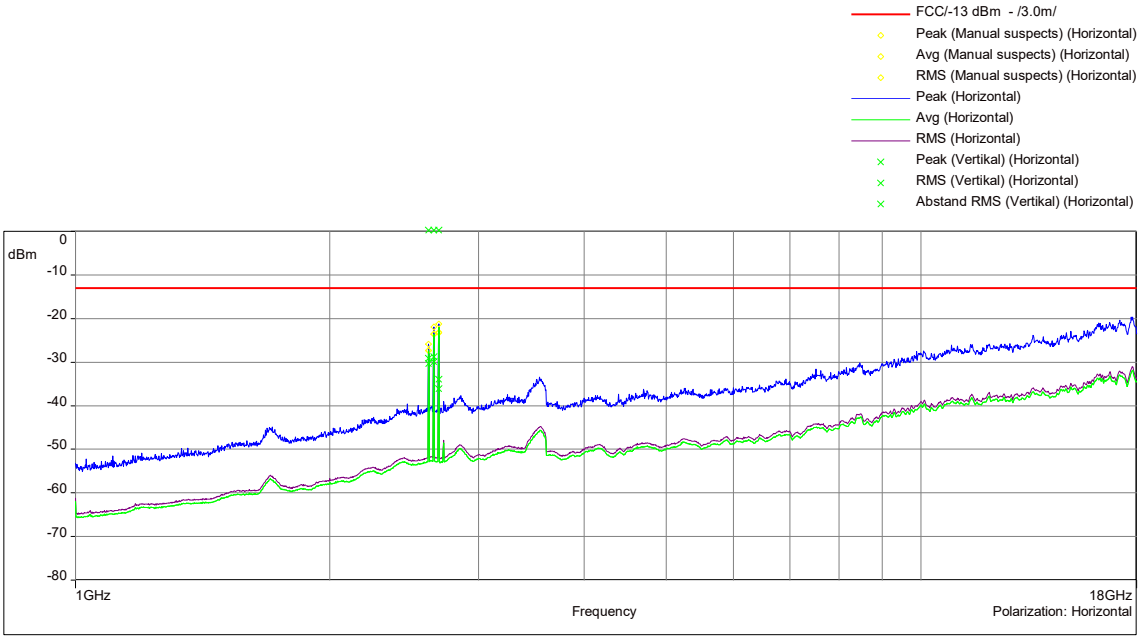




Frequency Band = BRS UBS, Test Frequency = low, Direction = RF downlink

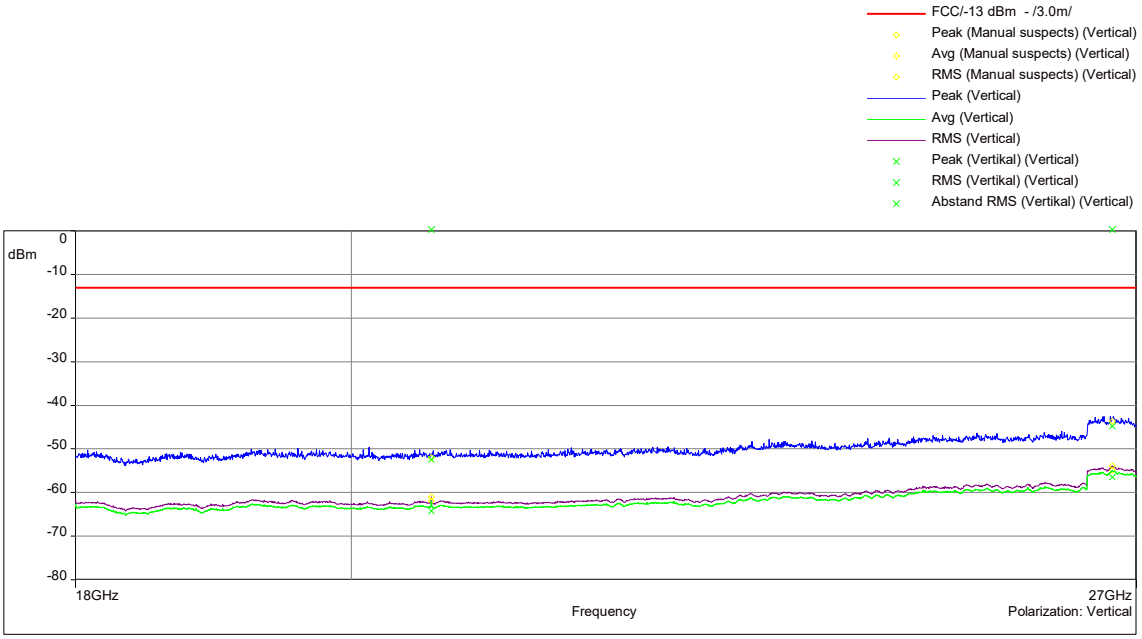
1 GHz - 18 GHz

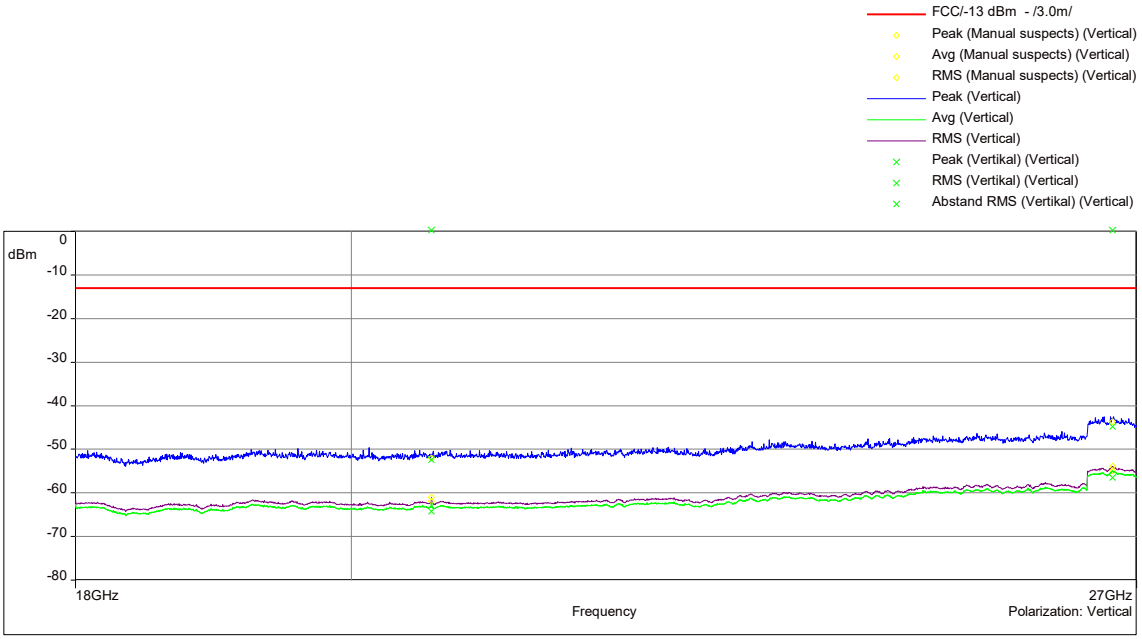




Frequency Band = BRS UBS, Test Frequency = low, Direction = RF downlink

18 GHz - 27 GHz





4.7.5 FIELD STRENGTH CALCULATIONS

FS = SA + AF + CL + PA

Where as:

FS = Field strength
SA = EMC test receiver reading
AF = Antenna factor
CL = Cable loss
PA = Preamplifier

4.7.6 TEST EQUIPMENT USED

- Radiated Emissions

5 TEST EQUIPMENT

1 Conducted

Ref.No.	Type	Description	Manufacturer	Inventory no.	Last Calibration	Calibration Due
1.1	FSV40	Signal Analyzer 10 Hz - 40 GHz	Rohde & Schwarz	E2050	2019-10	2020-10
1.2	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	G2089	2017-08/ 2020-08	2022-08
1.3	SMIQ	Vector Signal Generator 9 kHz – 3.3 GHz	Rohde & Schwarz	G1509	2018-10	2021-10
1.4	SMIQ	Vector Signal Generator 9 kHz – 3.3 GHz	Rohde & Schwarz	G1510	2018-10	2021-10
1.5	ESH3-Z5	Line Impedance Stabilisation Network (LISN) 150 Hz – 30 MHz	Rohde & Schwarz	K794	2019-02	2020-10
1.6	30.3015	ThermoHygro Datalogger	TFA	X 507	2018-08	2021-08
1.7	BAT-EMC	Software	Nexio	V3.17.0.26	---	---

2 Radiated Emissions

Ref.No.	Type	Description	Manufacturer	Inventory no.	Last Calibration	Calibration Due
2.1	ESU40	EMI test receiver 10 Hz - 40 GHz	Rohde & Schwarz	E2025	2018-10	2020-10
2.2	HFH2-Z2	Antenna 9 kHz – 30 MHz	Rohde & Schwarz	K549	2018-10	2020-10
2.3	CBL 6111C	Antenna 30 MHz – 1 GHz	Chase	K1026	2020-01	2021-01
2.4	HL 025	Antenna 1 GHz - 18 GHz	Rohde & Schwarz	K1114	2019-06	2021-06
2.5	MWH-1826/B	Antenna 18 GHz – 26.5 GHz	ARA Inc.	K1042	2018-11	2020-11
2.6	MWH-2640/B	Antenna 26 GHz - 40 GHz	ARA Inc.	K1043	2018-11	2020-11
2.7	AM1431	Pre amplifier 10 kHz – 1 GHz	Miteq	K1721	2019-10	2020-10
2.8	AFS4-00102000	Preamplifier 100 MHz - 20 GHz	Miteq	K817	2019-08	2021-08.
2.9	AFS4-00102000	Preamplifier 100 MHz - 20 GHz	Miteq	K838	2019-10	2020-10
2.10	JS43-1800-4000	Preamplifier 18 GHz - 40 GHz	Miteq	K1104	2019-05	2020-10
2.11	BAT-EMC	Software	Nexio	V3.17.0.26	---	---

6 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas.

6.1 ANTENNA CHASE CBL 6111C (30 MHZ – 1 GHZ)

(d = 10 m)

Frequency	AF Horizontal R&S CBL 6111C	AF Vertikal R&S CBL 6111C	Corr.
30	47.9	38.1	-38.1
50	34.4	26.4	-38.0
100	31.6	32.8	-38.0
150	33.7	33.9	-37.9
200	30.3	32.8	-37.7
250	33.6	36.5	-37.5
300	34.5	36.8	-37.1
350	36.3	37.2	-37.0
400	36.9	38.3	-36.8
450	38.0	39.6	-36.5
500	39.2	40.4	-36.0
550	41.2	42.1	-35.9
600	41.6	41.7	-35.7
650	41.9	42.9	-35.9
700	42.3	43.4	-35.6
750	43.5	43.9	-35.7
800	43.6	44.6	-36.0
850	45.0	45.1	-36.1
900	45.2	45.1	-36.6
950	46.4	46.4	-36.4
1000	45.8	47.0	-36.0

cable loss (antenna - pre-amp)	pre-amp	cable loss (inside chamber)	cable loss (to receiver)
-0,01	-38.3	0.0	0.1
0,28	-38.4	0.3	0.1
0,52	-38.7	0.5	0.2
0,73	-38.8	0.7	0.2
0,95	-38.9	1.0	0.3
1,10	-38.9	1.1	0.3
1,20	-38.6	1.2	0.3
1,29	-38.6	1.3	0.3
1,36	-38.5	1.4	0.3
1,42	-38.2	1.4	0.4
1,48	-37.9	1.5	0.4
1,54	-37.8	1.5	0.4
1,60	-37.7	1.6	0.4
1,64	-38.0	1.6	0.5
1,71	-37.8	1.7	0.5
1,76	-38.0	1.8	0.5
1,80	-38.3	1.8	0.5
1,84	-38.4	1.8	0.5
1,91	-39.0	1.9	0.5
1,93	-38.9	1.9	0.6
1,99	-38.6	2.0	0.6

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.2 ANTENNA ROHDE & SCHWARZ HL 025 (1 GHZ – 18 GHZ)

Frequency	AF R&S HL 025	Corr.	pre-amp	cable loss (to receiver)
MHz	dB (1/m)	dB	dB	dB
1000	33.2	-18.9	-20.92	2.01
2000	39.4	-17.8	-20.60	2.78
3000	42.8	-17.0	-20.44	3.42
4000	45.1	-16.6	-20.58	3.99
5000	46.8	-16.6	-21.08	4.46
6000	48.5	-16.7	-21.53	4.87
7000	50.2	-16.2	-21.53	5.35
8000	50.4	-15.3	-20.97	5.66
9000	51.9	-14.4	-20.44	6.05
10000	53.8	-14.0	-20.43	6.45
11000	54.5	-14.1	-20.84	6.69
12000	55.3	-14.4	-21.41	7.04
13000	55.7	-14.7	-22.09	7.36
14000	56.5	-14.8	-22.48	7.66
15000	56.4	-14.7	-22.56	7.90
16000	57.2	-14.3	-22.49	8.20
17000	57.6	-14.5	-22.90	8.45
18000	57.6	-14.6	-23.27	8.71

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

6.3 ANTENNA ARA INC. MWH-1826-B (18 GHZ – 26.5 GHZ) PARTIALLY IN CONJUNCTION WITH PRE-AMPLIFIER MITEQ JS43-1800-4000: THE USE OF THE PRE-AMPLIFIER IS DEPENDENT FROM THE FIELD STRENGTH

Frequency	AF EMCO 3160-09	Corr.	pre-amp	cable loss (to receiver)
MHz	dB (1/m)	dB	dB	dB
18000	44.3	-37.5	-46.2	8.7
18500	43.9	-37.6	-46.4	8.8
19000	44.4	-36.9	-45.9	9.0
19500	44.1	-36.1	-45.2	9.1
20000	44.6	-36.3	-45.6	9.3
20500	44.9	-36.1	-45.5	9.4
21000	45.2	-35.9	-45.3	9.4
21500	45.0	-35.7	-45.3	9.7
22000	45.1	-35.3	-45.1	9.8
22500	45.4	-35.0	-44.8	9.8
23000	45.7	-35.6	-45.5	9.9
23500	45.8	-34.3	-44.4	10.1
24000	45.3	-34.8	-45.0	10.2
24500	45.3	-35.0	-45.3	10.4
25000	46.1	-34.3	-44.8	10.5
25500	46.5	-34.2	-44.7	10.5
26000	46.7	-34.8	-45.4	10.6
26500	46.5	-34.4	-45.1	10.7
27000	46.4	-35.1	-46.0	10.9

Sample calculation

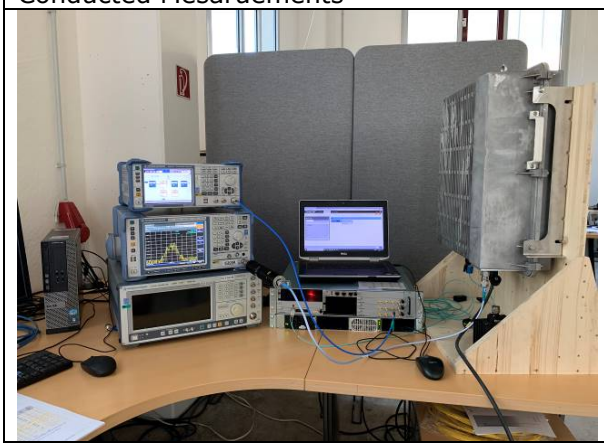
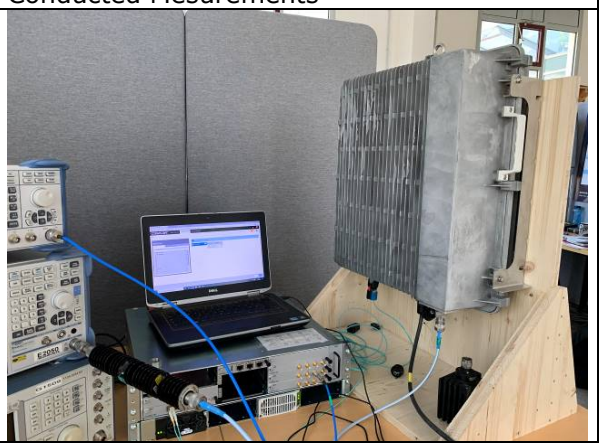
E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

7 MEASUREMENT UNCERTAINTIES

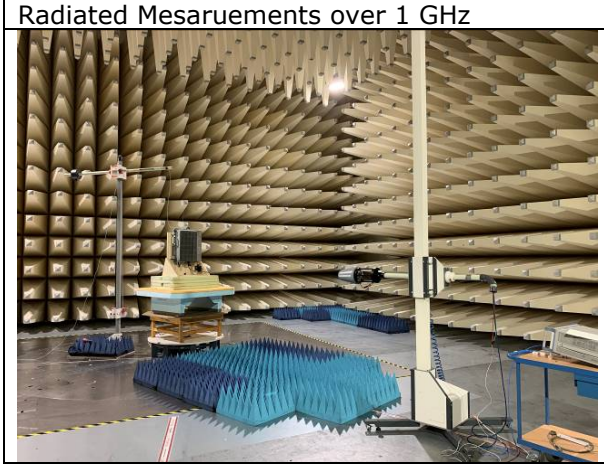
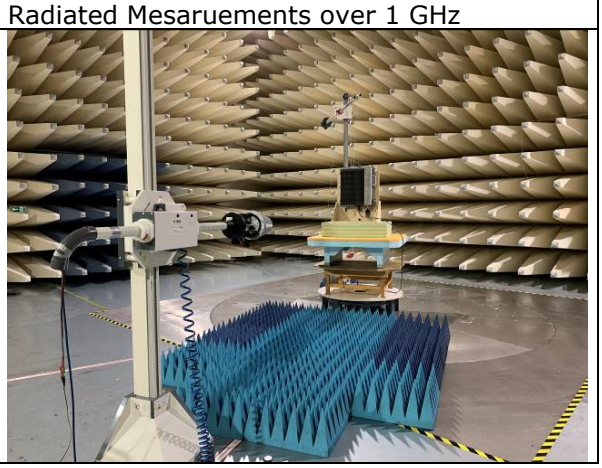
KDB 935210 D05	ECL
Power measurement	0,68 dB
Measuring AGC threshold level	0,90 dB
Out of band rejection	0,90 dB
Input-versus-output signal comparison	0,91 dB
Mean power output	0,90 dB
Measuring out-of-band/out-of-block (including intermodulation) emissions and spurious emissions	0,90 dB
Out-of-band/out-of-block emissions conducted measurements	0,90 dB
Spurious emissions conducted	2,18 dB
Spurious emissions radiated mesurements	5,38 dB
Total frequency uncertainty	2×10^{-7}

Reference : ECL-MU5.4.6.3-EMC-14-001-V03.00 MU Wireless.xlsx

8 PHOTO REPORT

Conducted Mesaruements	Conducted Mesurements
	

Radiated Mesaruements 30 MHz up to 1 GHz	Radiated Mesaruements 30 MHz up to 1 GHz
	

Radiated Mesaruements over 1 GHz	Radiated Mesaruements over 1 GHz
	

Annex A: Accreditation certificate (for information)

The accreditation relates to competences stated on the accreditation certificate. The current certificate is available on the homepage of the DAkkS and can be downloaded under accredited bodies with the processing number:
https://www.dakks.de/en

Annex B: Additional information provided by client

None.

****** End of test report *****

Thomas Gerngroß
Test Engineer

Digitally signed by Thomas Gerngroß
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Date: 2020.12.04 13:59:06 +01'00'

Thomas Hufnagel
Test Engineer

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Date: 2020.12.04 14:02:09 +01'00'