



ECL-TA Test Report No.: 20-023

| | |
|------------------------|--|
| Designation: | CAP H 80-85_17E_19_26 F-AC-F1-APE, Band 7 |
| Manufacturer: | Andrew |
| Serial No(s): | BGCHIA2043001 |
| ID No. | 7841153-0001 |
| Test Specification(s): | ANSI 63.26:2015 FCC Rules and Regulations as listed in 47 CFR, Part 20:2019-10-01 |
| Test Plan: | Measurement of Band 7, downlink. |
| Test Result: | Passed |

| | | | |
|-------------------|-----------------------------|---------------------|------------|
| Date of issue: | 2021-01-27 | | Signature: |
| Version: | 01 | Technical Reviewer: | |
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| Performance date: | 2020-12-14. – 2021-01-19 | | |



Deutsche
Akkreditierungsstelle
D-PL-12024-06-02

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Commscope

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Versions management:

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Initial release



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1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization

Certification for an Industrial Signal Booster.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2, 20 and 27. The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 20, Commercial Mobile Services

§ 20.21 Signal Boosters

Part 27; Miscellaneous Wireless Communications Services
Subpart C – Technical standards

§ 27.50 – Power and antenna height limits

§ 27.54 – Frequency stability

§ 27.53 – Emission limitations for broadband PCS equipment

The tests were selected and performed with reference to:

- FCC Public Notice 935210 applying "Signal Boosters Basic Certification Requirements" 935210 D02, 2019-15-04.
- FCC Public Notice 935210 applying "Measurement guidance for industrial and non-consumer signal booster, repeater and amplifier devices" 935210 D05, 2019-04-03.
- FCC Public Notice 971168 applying "Measurement guidance for certification of licensed digital transmitters" 971168 D01, 2019-04-09.
- ANSI C63.26: 2015



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Summary Test Results:

The EUT complies with all performed tests as listed in chapter 1.3 Measurement Summary/Signatures.

1.2 FCC-ISED CORRELATION TABLE

**Correlation of measurement requirements for
Industrial Signal Booster from FCC and ISED Canada**

| Measurement | FCC reference | ISED reference |
|--|---|---|
| Effective radiated power, mean output power and zone enhancer gain | § 2.1046 § 27.50 KDB 935210 D05 v01r04: 3.5 | RSS-GEN Issue 5, 6.12 RSS-131 Issue 3: 5.2.3 RSS-199 Issue 3, 4.4 SRSP-517, Issue 7, 5.1.1 |
| Peak to Average Ratio | § 27.50 | RSS-199 Issue 3, 6.4 |
| Occupied bandwidth Input-versus-output spectrum | § 2.1049 KDB 935210 D05 v01r04: 3.4 | RSS-GEN Issue 5, 6.7 RSS-131 Issue 3: 5.2.2 |
| Conducted spurious Emission at Antenna Terminal | § 2.1051 § 27.53 KDB 935210 D05 v01r04: 3.6 | RSS-GEN Issue 5, 6.13 RSS-199 Issue 3, 4.5 |
| Out-of-band emissions limits | § 2.1051 § 27.53 KDB 935210 D05 v01r04: 3.6 | RSS-GEN Issue 5, 6.13 RSS-199 Issue 3, 4.5 |
| Frequency stability | § 2.1055 § 27.54 | RSS-GEN Issue 5, 6.11 RSS-131 Issue 3: 5.2.4 RSS-199 Issue 3, 4.3 |
| Field strength of spurious radiation | § 2.1053 § 27.53 | RSS-GEN Issue 5, 6.13 RSS-199 Issue 3, 4.5 |
| Out-of-band rejection | KDB 935210 D05 v01r04: 3.3 | RSS-131 Issue 3: 5.2.1 |
| All measurements | ANSI 63.26 | ANSI 63.26 |

The test case frequency stability was not performed since the EUT is not equipped with signal processing capabilities. According KDB 935210 D05 in this case a measurement is not required.



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1.3 MEASUREMENT SUMMARY/SIGNATURES

Downlink frequencies: 2620 MHz to 2690 MHz

47 CFR CHAPTER I FCC PART 27 Subpart C [Base § 2.1046, § 27.50 Stations/Repeater]

Effective Radiated Power, mean output power and zone enhancer gain
The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r04: 3.5

Final Result

OP-Mode

Frequency Band, Direction, Input Power, Signal Type
BAND 7, RF downlink, 0.3 dB < AGC, Narrowband
BAND 7, RF downlink, 0.3 dB < AGC, Wideband
BAND 7, RF downlink, 3 dB > AGC, Narrowband
BAND 7, RF downlink, 3 dB > AGC, Wideband

Table with 2 columns: FCC, IC. All entries are 'Passed'.

47 CFR CHAPTER I FCC PART 27 Subpart C [Base § 27.50 Stations/Repeater]

Peak to Average Ratio
The measurement was performed according to ANSI C63.26

Final Result

OP-Mode

Frequency Band, Direction, Input Power, Signal Type
BAND 7, RF downlink, 0.3 dB < AGC, Narrowband
BAND 7, RF downlink, 0.3 dB < AGC, Wideband
BAND 7, RF downlink, 3 dB > AGC, Narrowband
BAND 7, RF downlink, 3 dB > AGC, Wideband

Table with 2 columns: FCC, IC. All entries are 'Passed'.

47 CFR CHAPTER I FCC PART 27 Subpart C [Base § 2.1049 Stations/Repeater]

Occupied Bandwidth/Input-versus-output Spectrum
The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r04: 3.4

Final Result

OP-Mode

Frequency Band, Direction, Input Power, Signal Type
BAND 7, RF downlink, 0.3 dB < AGC, Narrowband
BAND 7, RF downlink, 0.3 dB < AGC, Wideband
BAND 7, RF downlink, 3 dB > AGC, Narrowband
BAND 7, RF downlink, 3 dB > AGC, Wideband

Table with 2 columns: FCC, IC. All entries are 'Passed'.



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47 CFR CHAPTER I PART 27 Subpart C [Base Stations/Repeater] § 2.1051, § 27.53

Conducted spurious emissions at antenna terminals
The measurement was performed according to ANSI C63.26 **Final Result**

| OP-Mode | FCC | IC |
|---|------------|-----------|
| Frequency Band, Direction, Input Power, Signal Type | | |
| BAND 7, RF downlink, 0.3 dB < AGC, Narrowband | Passed | Passed |
| BAND 7, RF downlink, 0.3 dB < AGC, Wideband | Passed | Passed |
| BAND 7, RF downlink, 3 dB > AGC, Narrowband | Passed | Passed |
| BAND 7, RF downlink, 3 dB > AGC, Wideband | Passed | Passed |

47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater] § 2.1051, § 27.53

Out-of-band emission limits
The measurement was performed according to ANSI C63.26, KDB
935210 D05 v01r04: 3.6 **Final Result**

| OP-Mode | FCC | IC |
|---|------------|-----------|
| Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type | | |
| Lower, BAND 7, 1, RF downlink, 0.3 dB < AGC, Narrowband | Passed | Passed |
| Lower, BAND 7, 1, RF downlink, 0.3 dB < AGC, Wideband | Passed | Passed |
| Lower, BAND 7, 1, RF downlink, 3 dB > AGC, Narrowband | Passed | Passed |
| Lower, BAND 7, 1, RF downlink, 3 dB > AGC, Wideband | Passed | Passed |
| Lower, BAND 7, 2, RF downlink, 0.3 dB < AGC, Narrowband | Passed | Passed |
| Lower, BAND 7, 2, RF downlink, 0.3 dB < AGC, Wideband | Passed | Passed |
| Lower, BAND 7, 2, RF downlink, 3 dB > AGC, Narrowband | Passed | Passed |
| Lower, BAND 7, 2, RF downlink, 3 dB > AGC, Wideband | Passed | Passed |
| Upper, BAND 7, 1, RF downlink, 0.3 dB < AGC, Narrowband | Passed | Passed |
| Upper, BAND 7, 1, RF downlink, 0.3 dB < AGC, Wideband | Passed | Passed |
| Upper, BAND 7, 1, RF downlink, 3 dB > AGC, Narrowband | Passed | Passed |
| Upper, BAND 7, 1, RF downlink, 3 dB > AGC, Wideband | Passed | Passed |
| Upper, BAND 7, 2, RF downlink, 0.3 dB < AGC, Narrowband | Passed | Passed |
| Upper, BAND 7, 2, RF downlink, 0.3 dB < AGC, Wideband | Passed | Passed |
| Upper, BAND 7, 2, RF downlink, 3 dB > AGC, Narrowband | Passed | Passed |
| Upper, BAND 7, 2, RF downlink, 3 dB > AGC, Wideband | Passed | Passed |



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47 CFR CHAPTER I FCC PART 27 Subpart C [Base KDB 935210 D05 v01r04: 3.3 Stations/Repeater]

Out-of-band rejection

The measurement was performed according to ANSI C63.26, 935210
D05 v01r04: 3.3

Final Result

OP-Mode

Frequency Band, Direction

BAND 7, RF downlink

Setup

FCC

IC

Passed

Passed

47 CFR CHAPTER I FCC PART 27 Subpart C [Base § 2.1053, § 27.53 Stations/Repeater]

Field strength of spurious radiation

The measurement was performed according to ANSI C63.26

Final Result

OP-Mode

Frequency Band, Test Frequency, Direction

BAND 7, high, RF downlink

BAND 7, low, RF downlink

BAND 7, mid, RF downlink

FCC

IC

Passed

Passed

Passed

Passed

Passed

Passed



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2 ADMINISTRATIVE DATA

2.1 TESTING LABORATORY

Bureau Veritas Consumer Products Services Germany GmbH
Thurn-und-Taxis-Straße 18
D-90411 Nürnberg
Tel.: +49 40 74041 0
Fax: +49 40 74041-2755

2.2 APPLICANT DATA

Company Name: Commscope
Andrew Wireless Systems GmbH

Address: Industriering 10
86675 Buchdorf
Germany

Contact Person: Mr. Frank Futter

2.3 MANUFACTURER DATA

Company Name: Please see applicant data.

Address:



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3 TEST OBJECT DATA

3.1 GENERAL EUT DESCRIPTION

| | |
|--|--|
| Kind of Device product description | Cellular Repeater |
| Product name | Cellular Repeater |
| Type | |
| Declared EUT data by the supplier | |
| General Product Description | The EUT is an industrial signal booster supporting the following: Band 7: downlink: 2620 MHz - 2690 MHz; uplink: 2500 MHz to 2570 MHz A RF operation is supported for downlink. |
| Booster Type | Industrial Signal Booster |
| Voltage Type | AC/50 Hz – 60 Hz |
| Voltage Level | 100 V - 240 V |
| Nominal Output Donor Port [Uplink] | ----- |
| Nominal Output Server Port [Downlink] | 41.7 dBm |
| Nominal Gain [Uplink] | ----- |
| Nominal Gain [Downlink] | 36.7 dB |

The main components of the EUT are listed and described in chapter 3.2 EUT Main components.



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3.2 EUT MAIN COMPONENTS

| Sample Name | FCC-ID | ISED-ID |
|-------------------------|-----------------|-------------------|
| | XS5-CAPH8171926 | 2237E-CAPH8171926 |
| Sample Parameter | Value | |
| Serial Number | BGCHIA2043001 | |
| HW Version | 7841153-0001 | |
| SW Version | SW 2.8.2.42 | |
| Comment | ----- | |

NOTE: The short description is used to simplify the identification of the EUT in this test report.

3.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

| Device | Details (Manufacturer, Type Model, OUT Code) | Description |
|---------------|---|--------------------|
| - | - | - |



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3.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

| Device | Details (Manufacturer; Type; S/N) | Description |
|---------------|---|--|
| AUX1 | Lineage Power; SP800; XK20007 | Rack in Conjunction with AUX 2 and AUX 3 |
| AUX2 | Cherokee International; CAR1212FPBC-Z;AF09676 | Power Supply |
| AUX 3 | Lineage Power; CP2000AC54TEP; CC109167565 | Power Supply |
| AUX4 | Commscope; ION-E WCS-2; SZAEAJ1819A0009 | Subrack in Conjunction with AUX 5,6. 7, 8 and 9 |
| AUX5 | Commscope; ION-E OPT; SZBEAD1722A0035 | Optical Card |
| AUX6 | Avago; AFBR 7095MZ 850 nm; AD170230AM1 | O/E-Converter |
| AUX7 | Commscope; 7642124-ENG-03; (e1)MA22 | LAN System Interface |
| AUX8 | Commscope; ION-E RFD; SZBEAG1825A0002 | RF Card |
| AUX9 | Commscope; ION-E RFD; SZBEAG1825A0012 | RF Card |



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3.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

| Setup | Combination of EUTs | Description and Rationale |
|--------------|----------------------------|----------------------------------|
| | | Setup for all tests |

OPERATING MODES

This chapter describes the operating modes of the EUT used for testing.

3.5.1 TEST CHANNELS

| Band [MHz] | Direction | Lower Frequency Band Edge [MHz] | Upper Frequency Band Edge [MHz] | Center Frequency [MHz] | Output-Port |
|-------------------|------------------|--|--|---------------------------------------|--------------------|
| 2620 – 2690 | downlink | 2620.00 | 2690.00 | 2655.00 | ANT |



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3.5.2 AUTOMATIC GAIN CONTROL LEVELS

| AGC Levels | | | | | | | |
|-------------|-----------|-------------|---------------------|-----------------------------|---------------------------|-----------------|-----------|
| Band [MHz] | Direction | Signal Type | AGC Start Pin [dBm] | AGC Start Pin -0.3 dB [dBm] | AGC Start Pin +3 dB [dBm] | Frequency [MHz] | Frequency |
| 2620 - 2690 | Downlink | Narrowband | 4.4 | 4.1 | 7.4 | 2655.00 | Mid |
| 2620 - 2690 | Downlink | Wideband | 5.0 | 4.7 | 8.0 | 2655.00 | |
| 2620 - 2690 | Downlink | Narrowband | 5.6 | 5.3 | 8.6 | 2620.20 | Low |
| 2620 - 2690 | Downlink | Wideband | 6.8 | 6.5 | 9.8 | 2622.50 | |
| 2620 - 2690 | Downlink | Narrowband | 6.4 | 6.1 | 9.4 | 2689.80 | High |
| 2620 - 2690 | Downlink | Wideband | 6.4 | 6.1 | 9.4 | 2687.50 | |
| 2620 - 2690 | Downlink | Narrowband | 4.2 | 3.9 | 7.2 | 2653.34 | Max.Power |
| 2620 - 2690 | Downlink | Wideband | 5.4 | 5.1 | 8.4 | 2653.34 | |

Remark:

If the measured frequency f_0 for the max power has a too low distance to the band edges, because in the tests modulated signals must be used: The next possible frequency to the according band edge is used.

For example for minimum distances to the band edges:

GSM-Signal (narrowband): 0.2 MHz

AWGN-signal (wideband): 2.5 MHz

3.6 PRODUCT LABELLING

3.6.1 FCC ID LABEL

Please refer to the documentation of the applicant.

3.6.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

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4 TEST RESULTS

4.1 EFFECTIVE RADIATED POWER, MEAN OUTPUT POWER AND ZONE ENHANCER GAIN

Standard FCC PART 27, § 27.50

The test was performed according to:

ANSI C63.26, KDB 935210 D05 v01r04: 3.5

Test date: 2020-12-16

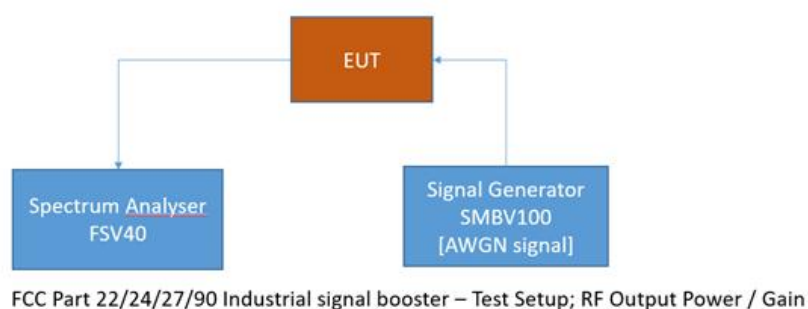
Environmental conditions: 23 ° C; 34 % r. F.

Test engineer: Thomas Gerngroß

4.1.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters per FCC § 27.50, RSS-199 with subpart 4.4 and SRSP-517 with subpart 5.1.1.

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



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.



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4.1.2 TEST REQUIREMENTS/LIMITS: ABSTRACTS FROM STANDARDS

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§ 27.50

Abstract § 27.50 from FCC:

(h) The following power limits shall apply in the BRS and EBS:

(1) *Main, booster and base stations.* (i) The maximum EIRP of a main, booster or base station shall not exceed $33 \text{ dBW} + 10 \log(X/Y) \text{ dBW}$, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: $\text{EIRP} = 33 \text{ dBW} + 10 \log(X/Y) \text{ dBW} + 10 \log(360/\text{beamwidth}) \text{ dBW}$, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points.



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Abstract RSS-199 from ISED:

RSS-199; 4.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.)

The transmitter output power shall be measured in terms of average value.

For base station equipment, refer to SRSP-517 for the maximum permissible e.i.r.p.

Abstract SRSP-517 from ISED:

SRSP-517; 5.1 Radiated Power Limits and Antenna Height Limit

5.1.1 Fixed and Base Stations

Fixed and base stations (except fixed subscriber stations) are limited to a maximum permissible equivalent isotropically radiated power (e.i.r.p.) of 1640 W/MHz (i.e. no more than 1640 W e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. For all installations with antenna HAAT in excess of 300 metres, a corresponding reduction in e.i.r.p. according to Table 2 shall be applied.

Table 2 — Reduction to Maximum Allowable E.I.R.P. for HAAT > 300 m

| HAAT (m) | Reduction in maximum e.i.r.p. (dB) |
|--------------------------------|---|
| $300 < \text{HAAT} \leq 500$ | 2 |
| $500 < \text{HAAT} \leq 1000$ | 5 |
| $1000 < \text{HAAT} \leq 1500$ | 8 |
| $1500 < \text{HAAT} \leq 2000$ | 10 |



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4.1.3 TEST PROTOCOL

FCC Table

| Band 7, 2620 MHz – 2690 MHz, downlink | | | | | | | |
|---------------------------------------|--------------|-----------------|-------------------|------------------------------------|----------------------------------|----------------------|-----------|
| Signal Type | Input Power | Frequency [MHz] | Input Power [dBm] | Maximum Average Output Power [dBm] | Limit Average Output Power [dBm] | Margin to Limit [dB] | Gain [dB] |
| Wideband | 0.3 dB < AGC | 2653.34 | 5.1 | 40.7 | 62.2 | 21.6 | 35.6 |
| Wideband | 3 dB > AGC | 2653.34 | 8.4 | 40.7 | 62.2 | 21.5 | 32.3 |
| Narrowband | 0.3 dB < AGC | 2653.34 | 3.9 | 40.6 | 51.2 | 10.6 | 36.7 |
| Narrowband | 3 dB > AGC | 2653.34 | 7.2 | 40.6 | 51.2 | 10.6 | 33.4 |

For the output power limit the values are calculated with the channel bandwidths according § 27.50:

Formula for the AWGN signal with a channel bandwidth of 5 MHz:

$$p_{dBW} = 33 \text{ dBW} + 10 \log_{10} \frac{5 \text{ MHz}}{6 \text{ MHz}} = 32.2 \text{ dBW: This value equates } 62.2 \text{ dBm}$$

Formula for the GSM signal with a channel bandwidth of 0.4 MHz:

$$p_{dBW} = 33 \text{ dBW} + 10 \log_{10} \frac{0.4 \text{ MHz}}{6 \text{ MHz}} = 21.2 \text{ dBW: This value equates } 51.2 \text{ dBm}$$



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ISED Table

| Band 7. 2620 MHz – 2690 MHz. downlink | | | | | | | |
|---------------------------------------|--------------|-----------------|-------------------|----------------------------------|--------------------------------|----------------------|-----------|
| Signal Type | Input Power | Frequency [MHz] | Input Power [dBm] | Maximum Average Output Power [W] | Limit Average Output Power [W] | Margin to Limit [dB] | Gain [dB] |
| Wideband | 0.3 dB < AGC | 2653.34 | 5.1 | 11.8 | 164 | 11.4 | 35.6 |
| Wideband | 3 dB > AGC | 2653.34 | 8.4 | 11.7 | 164 | 11.5 | 32.3 |
| Narrowband | 0.3 dB < AGC | 2653.34 | 3.9 | 11.4 | 164 | 11.6 | 36.7 |
| Narrowband | 3 dB > AGC | 2653.34 | 7.2 | 11.4 | 164 | 11.6 | 33.3 |

For the output power limit the value of the ISED table at a height up to 2000 m (worst case) from SRSP-517; 5.1 is taken.

The calculation for the limit is:

Maximum allowed output power: 1640 W minus a reduction of 10 dB means a division of 1640 W by 10:

$$P_{\text{limit}} = \frac{1640 \text{ W}}{10} = 164 \text{ W}$$

Remark:

Please see next sub-clause for the measurement plot.



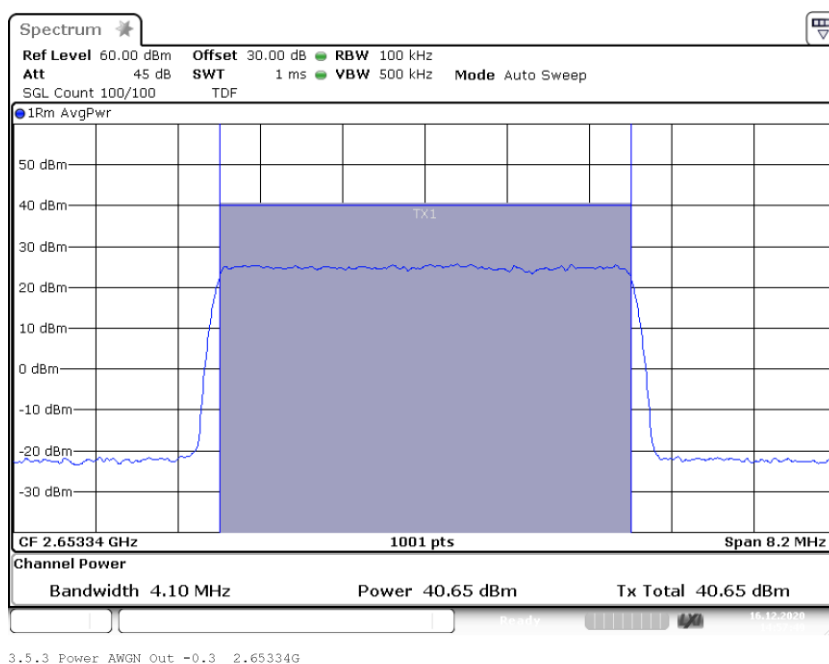
ECL-TA-20-023-V01.00

TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-F1-APE, Band 7

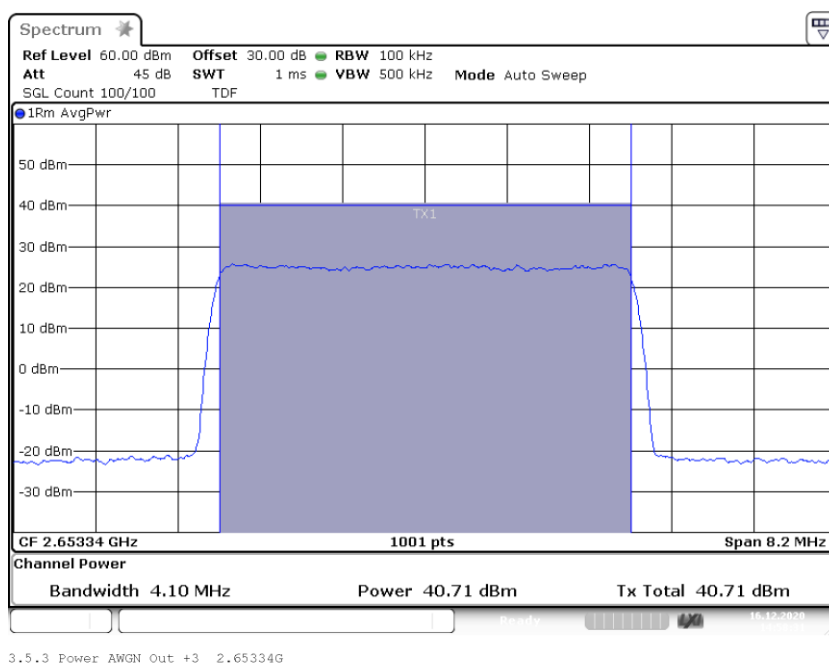
4.1.4 MEASUREMENT PLOT

FCC Plots

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: AWGN; Output Power 0.3 dB < AGC



Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: AWGN; Output Power 3 dB > AGC

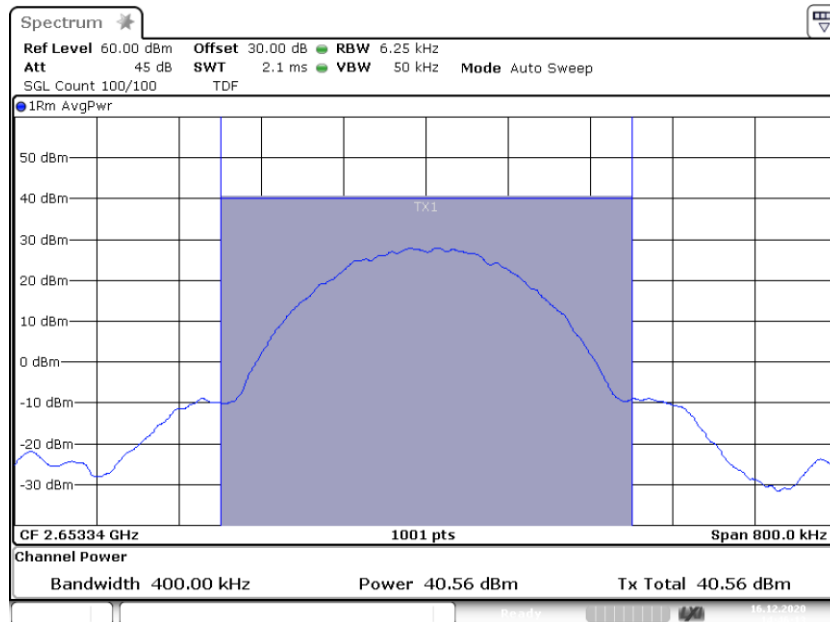




ECL-TA-20-023-V01.00

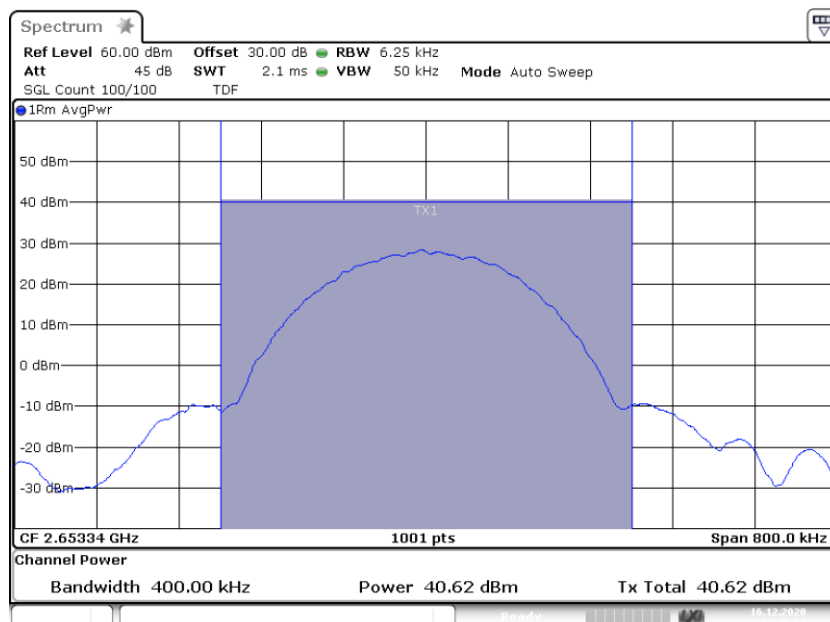
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: GSM; Input
Power 0.3 dB < AGC



3.5.3 Power GSM Out -0.3 2.65334G

Downlink: Band 7. 2620 MHz - 2690 MHz; 2653.34; Band Edge: f0; Mod: GSM; Output Power 3 dB
> AGC



3.5.3 Power GSM Out +3 2.65334G



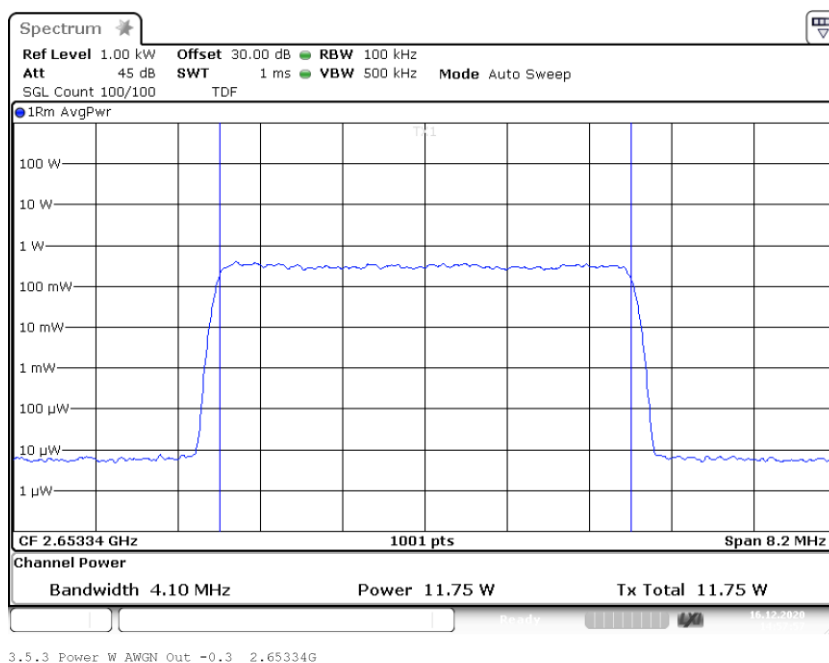
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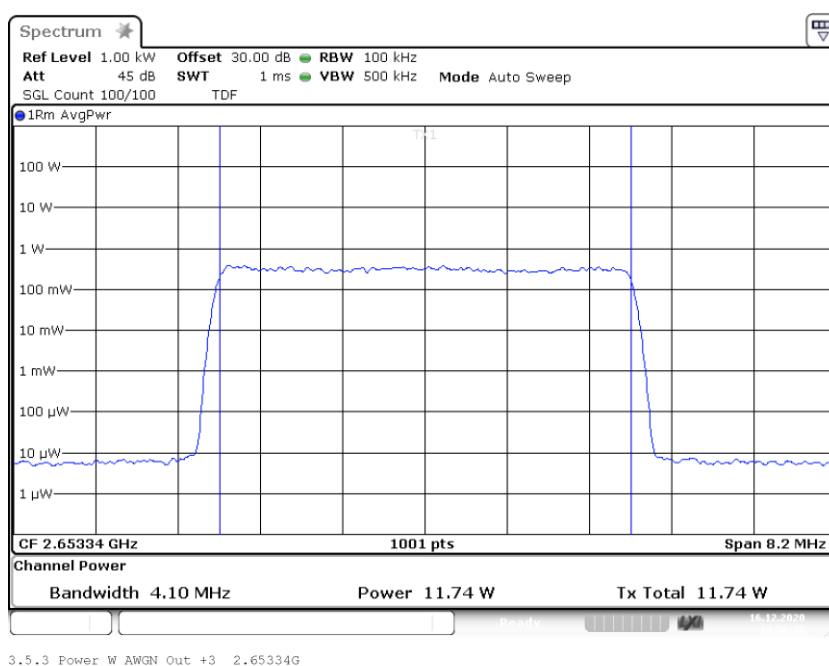
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

ISED Plots

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: AWGN;
Output Power 0.3 dB < AGC



Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: AWGN;
Output Power 3 dB > AGC



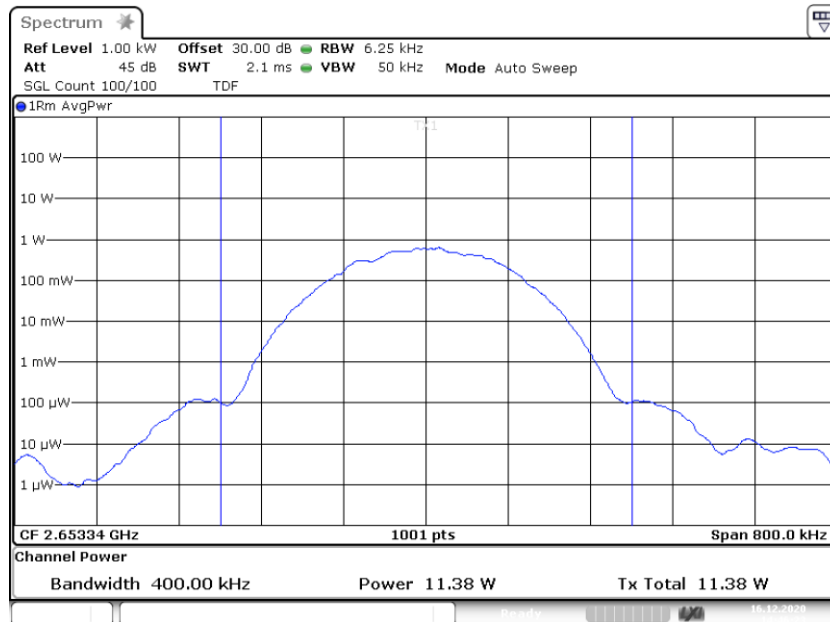


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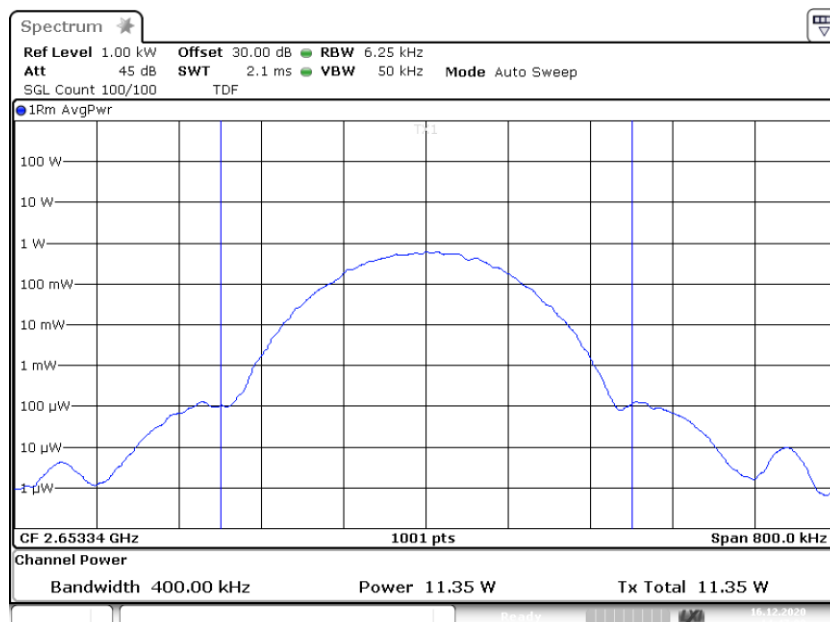
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2653.34; Band Edge: f0; Mod: GSM; Input
Power 0.3 dB < AGC



3.5.3 Power_W GSM Out -0.3 2.65334G

Downlink: Band 7. 2620 MHz - 2690 MHz; 2653.34; Band Edge: f0; Mod: GSM; Output Power 3 dB
> AGC



3.5.3 Power_W GSM Out +3 2.65334G



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.1.5 TEST EQUIPMENT USED

- Conducted



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.2 PEAK TO AVERAGE RATIO

Standard FCC PART 27. § 27.50

The test was performed according to:
ANSI C63.26

Test date: 2020-12-16

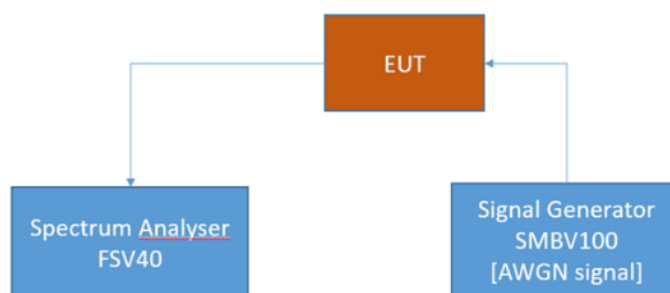
Environmental conditions: 23 ° C; 34 % r. F.

Test engineer: Thomas Gerngroß

4.2.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters per FCC § 27.50 and RSS-199 with subpart 4.4.

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



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-F1-APE, Band 7

4.2.2 TEST REQUIREMENTS/LIMITS

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§ 27.50

Abstract § 27.50 from FCC:

For the band 7 (BRS/EBS) exists no FCC peak-to-average power ratio (PAPR). therefore a fictive limit of 13 dB as at ISED RSS-199 is set.

Abstract RSS-199 from ISED:

RSS-199; 4.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.)

In addition. the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmissio

4.2.3 TEST PROTOCOL

| Band 7. 2620 MHz – 2690 MHz. downlink | | | | | | |
|--|--------------------|------------------------|--------------------------|------------------|--|-----------------------------|
| Signal Type | Input Power | Frequency [MHz] | Input Power [dBm] | PAPR [dB] | PAPR Limit (fictive for FCC and valid for ISED) | Margin to Limit [dB] |
| Wideband | 0.3 dB < AGC | 2655.00 | 4.7 | 8.35 | 13.00 | 4.65 |
| Wideband | 3 dB > AGC | 2655.00 | 8.0 | 8.35 | 13.00 | 4.65 |
| Narrowband | 0.3 dB < AGC | 2655.00 | 4.1 | 0.20 | 13.00 | 12.80 |
| Narrowband | 3 dB > AGC | 2655.00 | 7.4 | 0.29 | 13.00 | 12.71 |

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

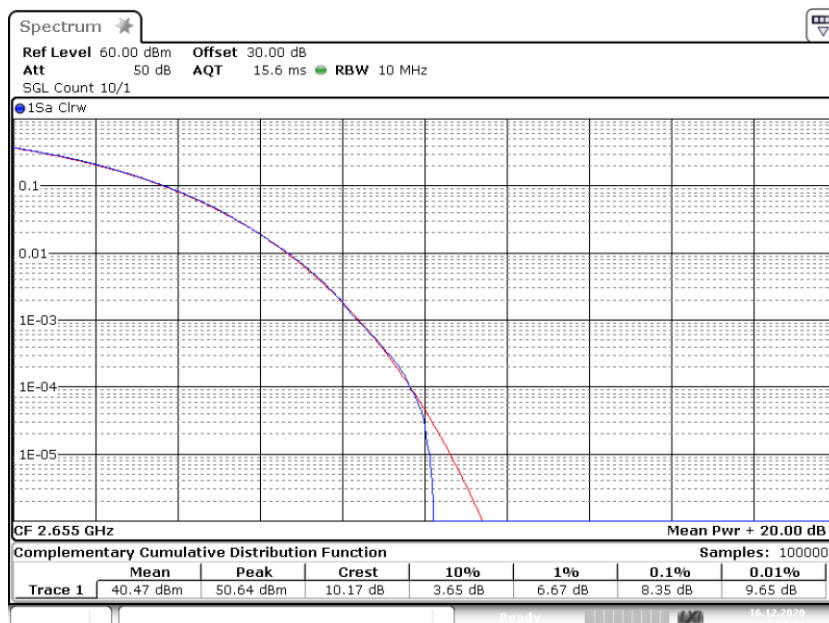


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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

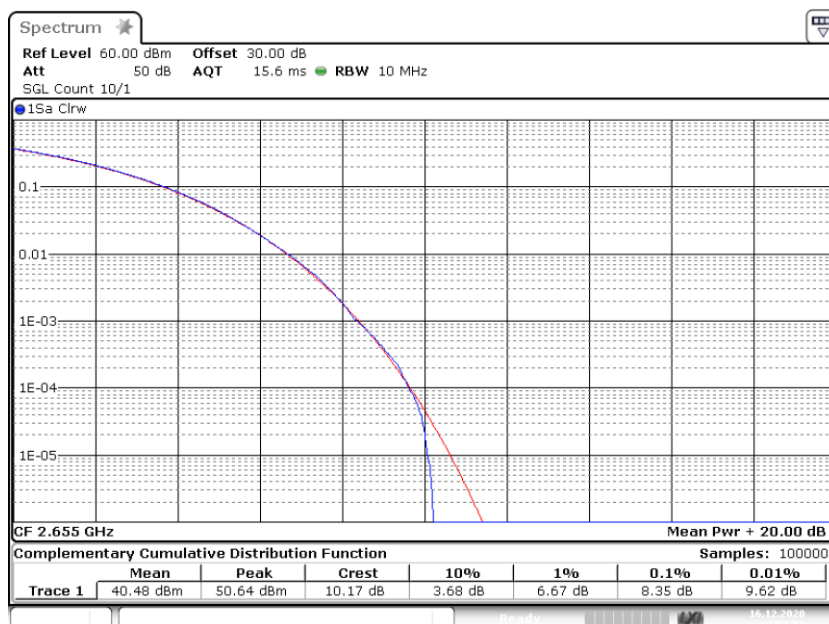
4.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE. "WORST CASE")

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2655.00; Band Edge: f0; Mod: AWGN; PAPR
0.3 dB < AGC



4.0 PAPR AWGN Out -0.3 2.655G

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2655.00; Band Edge: f0; Mod: AWGN; PAPR
3 dB > AGC



4.0 PAPR AWGN Out +3 2.655G

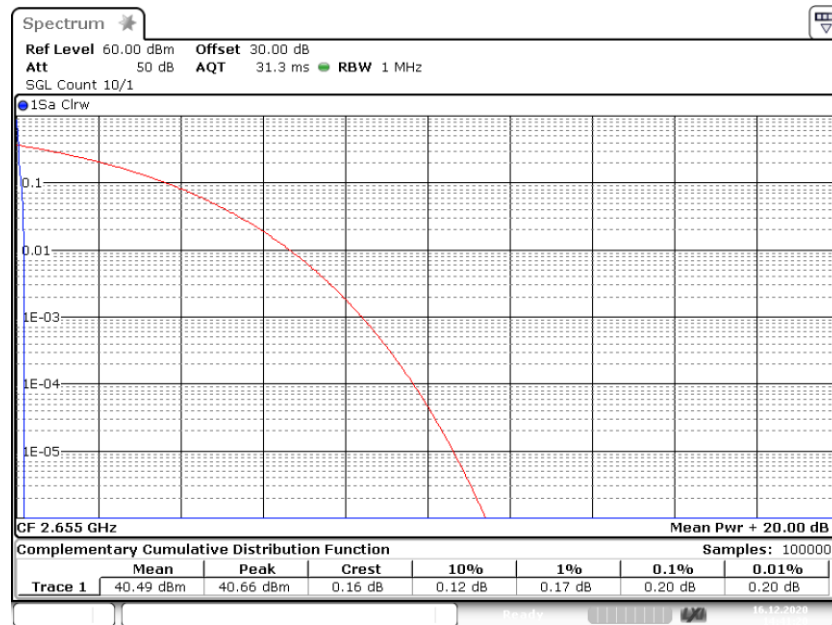


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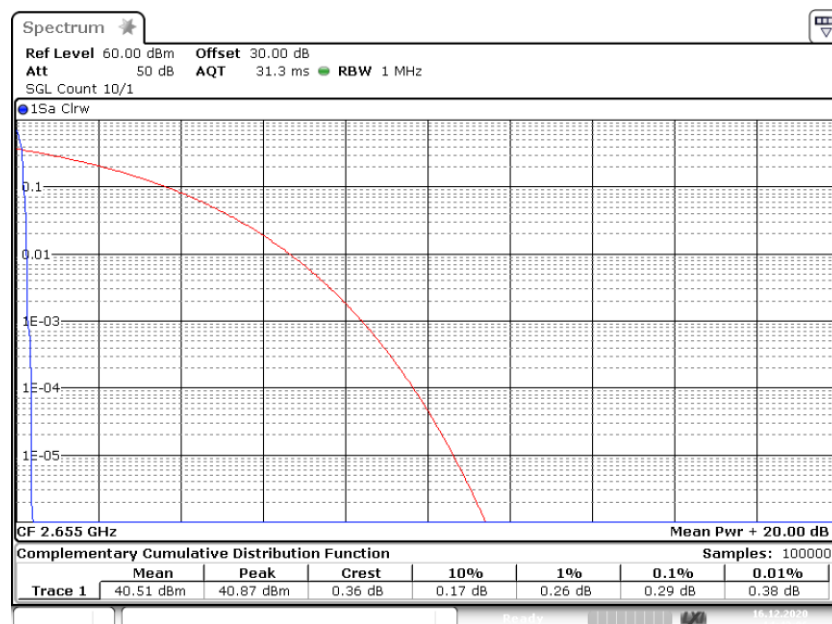
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2655.00 MHz; Band Edge: mid; Mod: GSM;
PAPR 0.3 dB < AGC



4.0 PAPR GSM Out -0.3 2.655G

Downlink: Band 7. 2620 MHz - 2690 MHz; Frequency: 2655.00 MHz; Band Edge: mid; Mod: GSM;
PAPR 3 dB > AGC



4.0 PAPR GSM Out +3 2.655G

4.2.5 TEST EQUIPMENT USED

- Conducted



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.3 OCCUPIED BANDWIDTH/INPUT-VERSUS-OUTPUT SPECTRUM

Standard FCC Part 2.1049

The test was performed according to:

ANSI C63.26. KDB 935210 D05 v01r04: 3.4

Test date: 2020-12-16

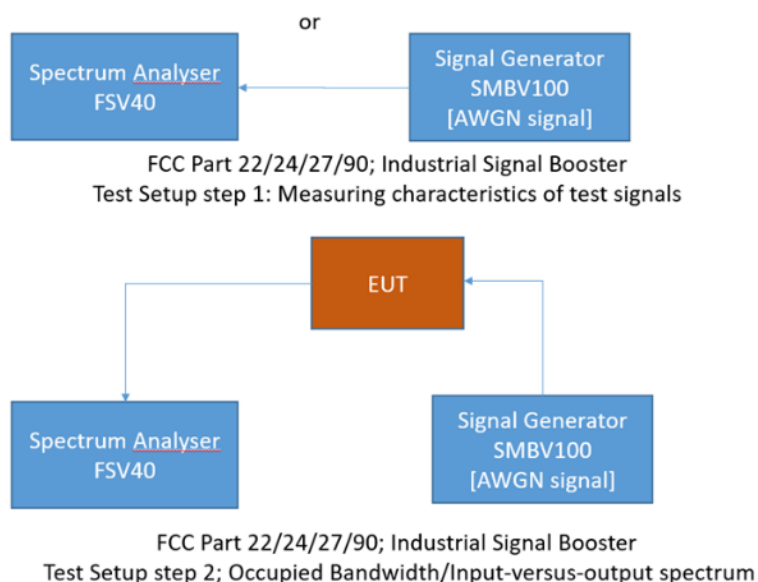
Environmental conditions: 23 ° C; 34 % r. F.

Test engineer: Thomas Gerngroß

4.3.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the applicable conducted spurious emission limits per FCC § 2.1049. RSS-GEN with subpart 6.7 and RSS-131 with subpart 5.2.2.

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



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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.3.2 TEST REQUIREMENTS/LIMITS

Abstract § 2.1049 from FCC:

FCC Part 2.1049; Occupied Bandwidth:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.3 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

Abstract RSS-GEN from ISED:

RSS-GEN; 6.7 Occupied Bandwidth

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-F1-APE, Band 7

- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Abstract RSS-131 from ISED:

RSS-131; 5.2.2 Input-versus-output spectrum

The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

4.3.3 TEST PROTOCOL

| Band 7. 2620 MHz – 2690 MHz. downlink | | | | | | | |
|---------------------------------------|--------------|------------------------|-----------------------------|----------------------------------|--------------------------------|--------------------------------------|-----------------------|
| Signal Type | Input Power | Signal Frequency [MHz] | Occupied Bandwidth SG [kHz] | Occupied Bandwidth Booster [kHz] | Delta Occupied Bandwidth [kHz] | Limit Delta Occupied Bandwidth [kHz] | Margin to Limit [kHz] |
| Wideband | 0.3 dB < AGC | 2655.00 | 4389.4 | 4389.4 | 0.0 | 205.0 | 205.0 |
| Wideband | 3 dB > AGC | 2655.00 | 4390.7 | 4391.9 | 1.2 | 205.0 | 203.8 |
| Narrowband | 0.3 dB < AGC | 2655.00 | 319.2 | 314.4 | 4.8 | 10.0 | 5.2 |
| Narrowband | 3 dB > AGC | 2655.00 | 315.5 | 315.1 | 0.4 | 10.0 | 9.6 |

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



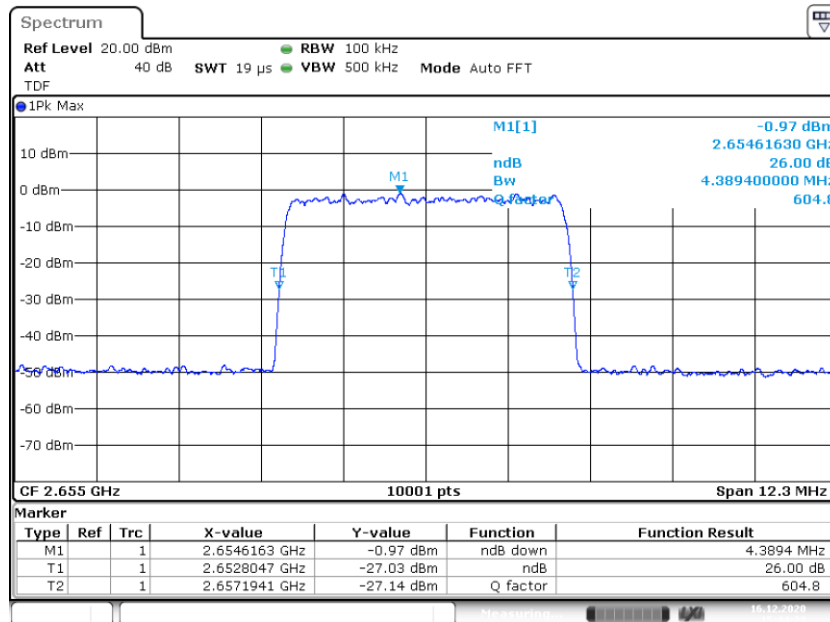
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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

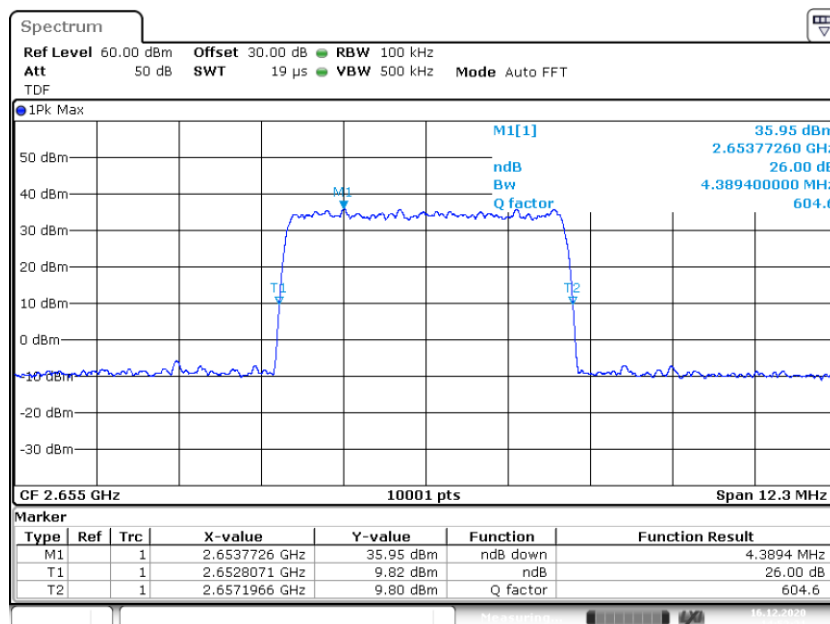
4.3.4 MEASUREMENT PLOT

Downlink: Band 7. 2110 MHz – 2180 MHz; Frequency: 2655.00 MHz MHz; Band Edge: mid; Mod:
AWGN; Input OCBw 0.3 dB < AGC



3.4 OCBw AWGN In -0.3 2.6550G _26dB

Input Signal



3.4 OCBw AWGN Out -0.3 2.6550G _26dB

Output Signal

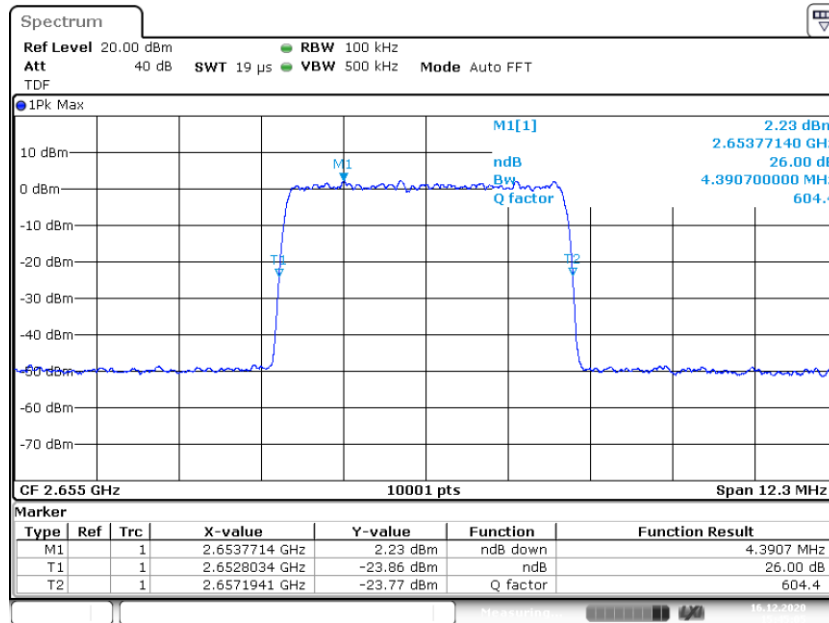


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ECL-TA-20-023-V01.00

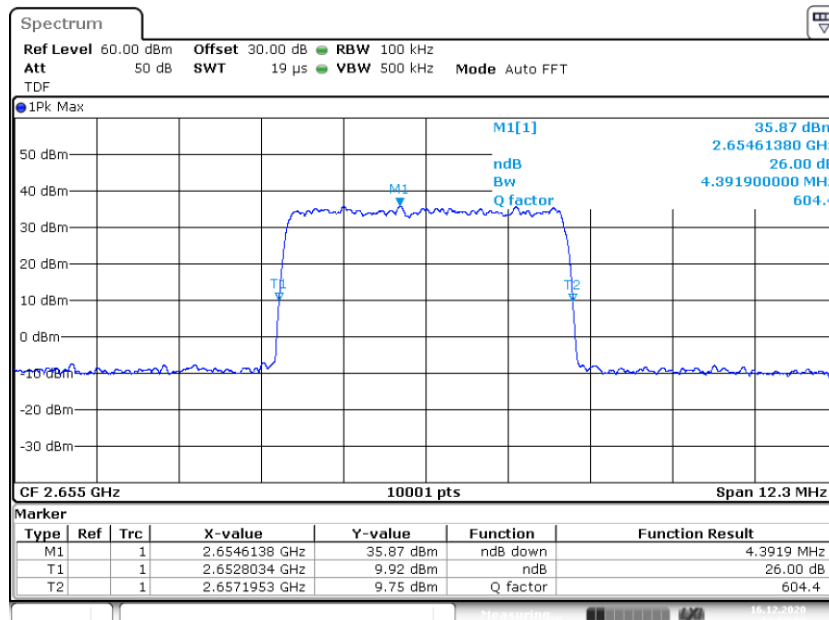
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2110 MHz – 2180 MHz; Frequency: 2655.00 MHz MHz; Band Edge: mid; Mod:
AWGN; Input OCBw 3 dB > AGC



3.4 OCBw AWGN In +3 2.6550G _26dB

Input Signal



3.4 OCBw AWGN Out +3 2.6550G _26dB

Output Signal

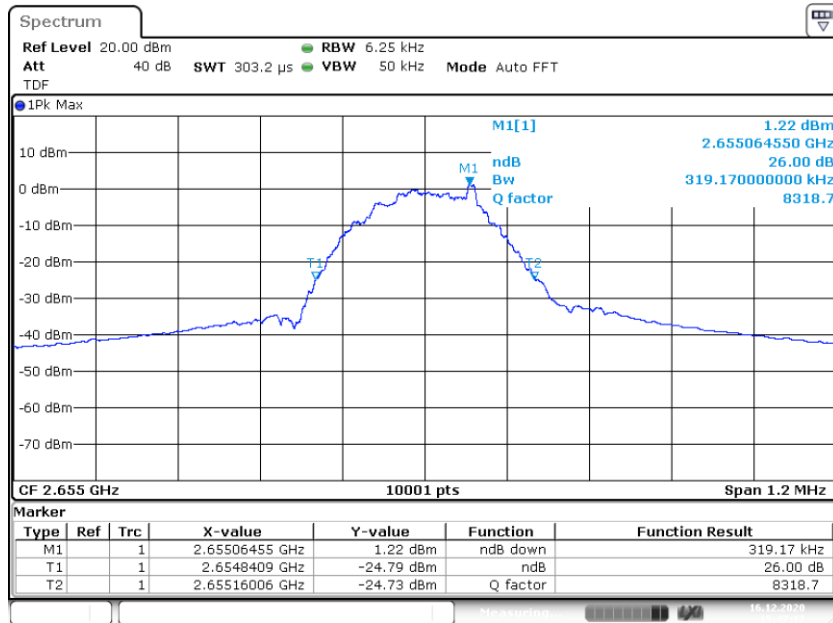


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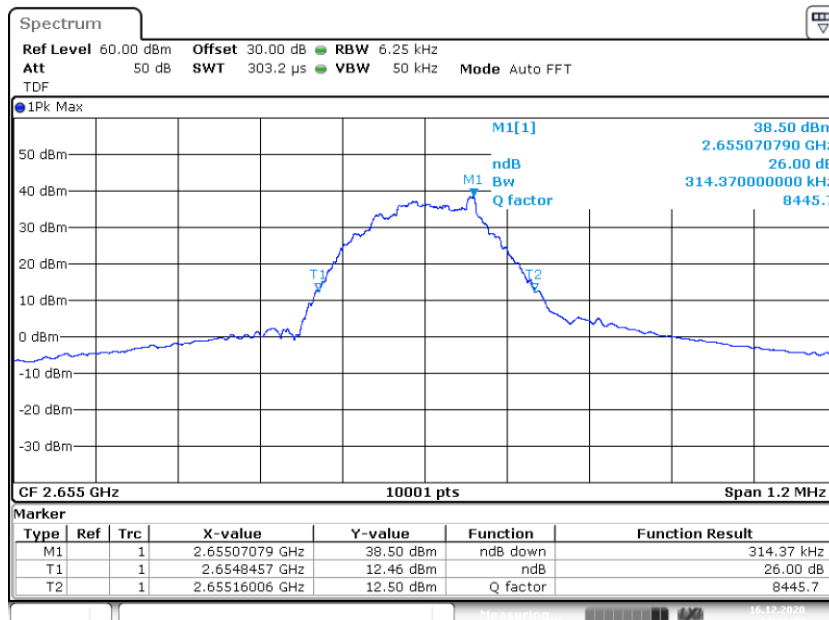
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2110 MHz – 2180 MHz; Frequency: 2655.00 MHz MHz; Band Edge: mid; Mod:
GSM; Input OCBw 0.3 dB < AGC



3.4 OCBw GSM In -0.3 2.6550G _26dB

Input Signal



3.4 OCBw GSM Out -0.3 2.6550G _26dB

Output Signal

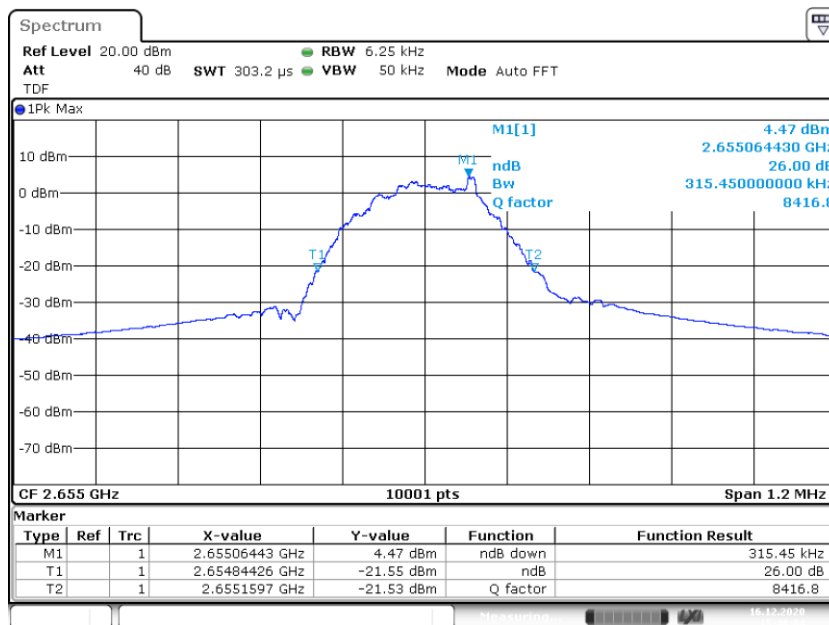


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ECL-TA-20-023-V01.00

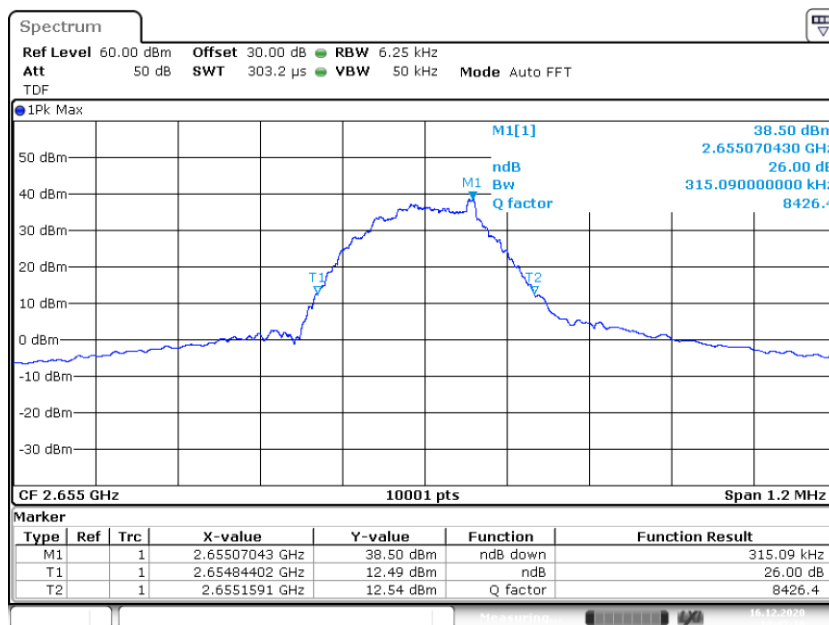
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7. 2110 MHz – 2180 MHz; Frequency: 2655.00 MHz MHz; Band Edge: mid; Mod: GSM; Input OCBw 3 dB > AGC



3.4 OCBw GSM In +3 2.6550G _26dB

Input Signal



3.4 OCBw GSM Out +3 2.6550G _26dB

Output Signal

4.3.5 TEST EQUIPMENT USED

- Conducted



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.4 CONDUCTED SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard FCC Part § 2.1051. § 27.53

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

Test date: 2021-01-19

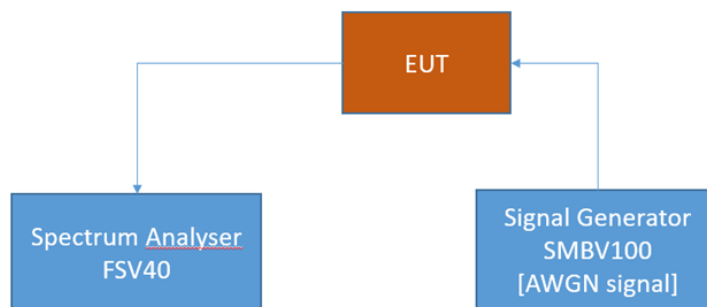
Environmental conditions: 22 ° C; 26 % r. F.

Test engineer: Thomas Gerngroß

4.4.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters 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; RF Output Power / Gain

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.4.2 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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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 $43 + 10 \log_{10} p$.

- (i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- (ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- (iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges.

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ 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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-

F1-APE, Band 7

4.4.3 TEST PROTOCOL

| Band 7. 2620 MHz – 2690 MHz. downlink | | | | | | | |
|--|--------------------|-----------------------------|-----------------------------|-----------------|------------------|--------------------|-----------------------------|
| Test Frequency | Signal Type | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| low | Wideband | 0.010782 | -50.3 | RMS | 1 | -33 | 17.3 |
| low | Wideband | 0.077495 | -43.4 | RMS | 10 | -23 | 20.4 |
| low | Wideband | 123.5 | -35.2 | RMS | 100 | -13 | 22.2 |
| low | Wideband | 878.9 | -17.5 | RMS | 1000 | -13 | 4.5 |
| low | Wideband | 2149.4 | -16.5 | RMS | 1000 | -13 | 3.5 |
| low | Wideband | 2618.8 | -27.3 | RMS | 100 | -23 | 4.3 |
| low | Wideband | 2697.5 | -36.5 | RMS | 100 | -23 | 13.5 |
| low | Wideband | 6817.5 | -21.1 | RMS | 1000 | -13 | 8.1 |
| low | Wideband | 19955.8 | -20.6 | RMS | 1000 | -13 | 7.6 |
| low | Wideband | 20335.7 | -19.6 | RMS | 1000 | -13 | 6.6 |
| mid | Wideband | 0.00902 | -49.3 | RMS | 1 | -33 | 16.3 |
| mid | Wideband | 0.062498 | -43.9 | RMS | 10 | -23 | 20.9 |
| mid | Wideband | 118.7 | -34.8 | RMS | 100 | -13 | 21.8 |
| mid | Wideband | 886.4 | -19.6 | RMS | 1000 | -13 | 6.6 |
| mid | Wideband | 1963.0 | -16.5 | RMS | 1000 | -13 | 3.5 |
| mid | Wideband | 2616.9 | -36.5 | RMS | 100 | -23 | 13.5 |
| mid | Wideband | 2691.1 | -36.0 | RMS | 100 | -23 | 13.0 |
| mid | Wideband | 6886.0 | -21.4 | RMS | 1000 | -13 | 8.4 |
| mid | Wideband | 19616.3 | -20.5 | RMS | 1000 | -13 | 7.5 |
| mid | Wideband | 20329.7 | -19.4 | RMS | 1000 | -13 | 6.4 |
| high | Wideband | 0.009553 | -48.7 | RMS | 1 | -33 | 15.7 |
| high | Wideband | 0.057499 | -43.0 | RMS | 10 | -23 | 20.0 |
| high | Wideband | 124.0 | -35.8 | RMS | 100 | -13 | 22.8 |
| high | Wideband | 884.4 | -19.5 | RMS | 1000 | -13 | 6.5 |
| high | Wideband | 2163.4 | -15.9 | RMS | 1000 | -13 | 2.9 |
| high | Wideband | 2613.6 | -35.9 | RMS | 100 | -23 | 12.9 |
| high | Wideband | 2691.5 | -30.2 | RMS | 100 | -23 | 7.2 |
| high | Wideband | 6817.5 | -20.9 | RMS | 1000 | -13 | 7.9 |
| high | Wideband | 19526.8 | -20.9 | RMS | 1000 | -13 | 7.9 |
| high | Wideband | 20278.7 | -19.1 | RMS | 1000 | -13 | 6.1 |



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-

F1-APE, Band 7

| Band 7. 2620 MHz – 2690 MHz. downlink | | | | | | | |
|--|--------------------|-----------------------------|-----------------------------|-----------------|------------------|--------------------|-----------------------------|
| Test Frequency | Signal Type | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| low | Narrowband | 0.017335 | -50.6 | RMS | 1 | -33 | 17.6 |
| low | Narrowband | 0.117489 | -45.6 | RMS | 10 | -23 | 22.6 |
| low | Narrowband | 187.4 | -35.6 | RMS | 100 | -13 | 22.6 |
| low | Narrowband | 876.4 | -19.5 | RMS | 1000 | -13 | 6.5 |
| low | Narrowband | 2163.4 | -16.6 | RMS | 1000 | -13 | 3.6 |
| low | Narrowband | 2617.7 | -34.4 | RMS | 100 | -23 | 11.4 |
| low | Narrowband | 2691.8 | -36.2 | RMS | 100 | -23 | 13.2 |
| low | Narrowband | 6915.5 | -21.1 | RMS | 1000 | -13 | 8.1 |
| low | Narrowband | 19605.8 | -20.4 | RMS | 1000 | -13 | 7.4 |
| low | Narrowband | 20320.7 | -19.4 | RMS | 1000 | -13 | 6.4 |
| mid | Narrowband | 0.015615 | -51.4 | RMS | 1 | -33 | 18.4 |
| mid | Narrowband | 0.132486 | -45.5 | RMS | 10 | -23 | 22.5 |
| mid | Narrowband | 68.6 | -35.6 | RMS | 100 | -13 | 22.6 |
| mid | Narrowband | 890.9 | -19.7 | RMS | 1000 | -13 | 6.7 |
| mid | Narrowband | 2145.4 | -16.7 | RMS | 1000 | -13 | 3.7 |
| mid | Narrowband | 2612.6 | -36.5 | RMS | 100 | -23 | 13.5 |
| mid | Narrowband | 2692.6 | -35.5 | RMS | 100 | -23 | 12.5 |
| mid | Narrowband | 6904.0 | -21.2 | RMS | 1000 | -13 | 8.2 |
| mid | Narrowband | 19539.3 | -20.1 | RMS | 1000 | -13 | 7.1 |
| mid | Narrowband | 20334.2 | -19.5 | RMS | 1000 | -13 | 6.5 |
| high | Narrowband | 0.011115 | -51.1 | RMS | 1 | -33 | 18.1 |
| high | Narrowband | 0.23247 | -46.2 | RMS | 10 | -23 | 23.2 |
| high | Narrowband | 65.8 | -35.3 | RMS | 100 | -13 | 22.3 |
| high | Narrowband | 870.9 | -19.2 | RMS | 1000 | -13 | 6.2 |
| high | Narrowband | 1963.0 | -16.9 | RMS | 1000 | -13 | 3.9 |
| high | Narrowband | 2613.5 | -36.2 | RMS | 100 | -23 | 13.2 |
| high | Narrowband | 2691.1 | -35.7 | RMS | 100 | -23 | 12.7 |
| high | Narrowband | 6972.0 | -20.8 | RMS | 1000 | -13 | 7.8 |
| high | Narrowband | 19563.8 | -20.7 | RMS | 1000 | -13 | 7.7 |
| high | Narrowband | 20310.2 | -19.8 | RMS | 1000 | -13 | 6.8 |

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



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

General considerations concerning the measurement plots:

The measuring bandwidth of 100 kHz was chosen according the test requirements except at the band edges: At the band edges reducing of measurement bandwidth was necessary to prevent overlaying the RF-signal over the spurious emissions.

Also outside the downlink frequency band at lower frequencies the measurement bandwidths were reduced to have the possibility to record the spurious emissions at these lower frequencies.

At frequencies where measuring bandwidths were reduced also the border lines were reduced according the given formula:

$$p_{RBWreduced} [dBm] = 10 * \log \left(RBWreduced [kHz] - 100 kHz \right) + p_{RBW 100 kHz} [dBm]$$

Hereby "p" are the border lines' values.



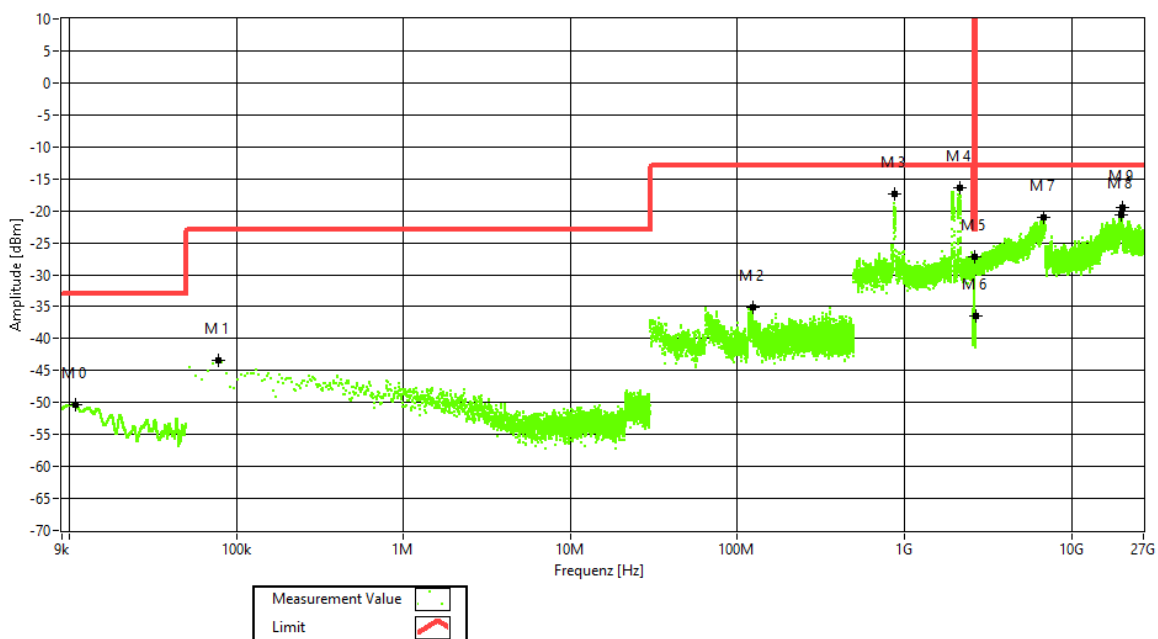
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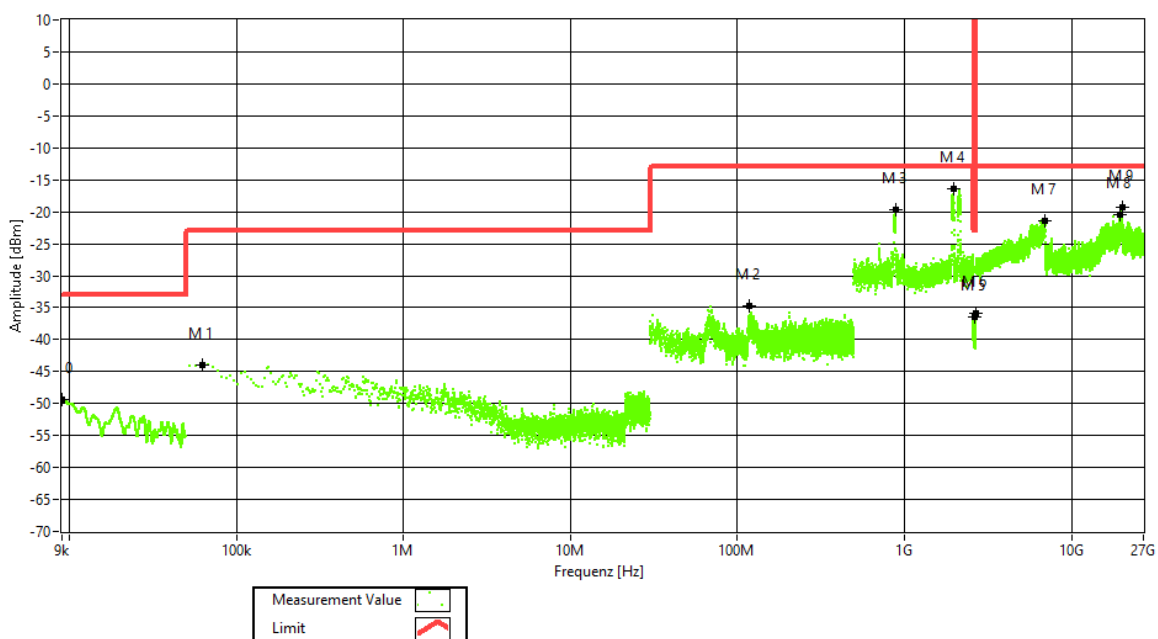
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.4.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE. "WORST CASE")

Frequency Band = Band 7. 2620 MHz - 2690 MHz. Test Frequency = low. Direction = RF
downlink. Signal Type = AWGN



Frequency Band = Band 7. 2620 MHz - 2690 MHz. Test Frequency = mid. Direction = RF
downlink. Signal Type = AWGN



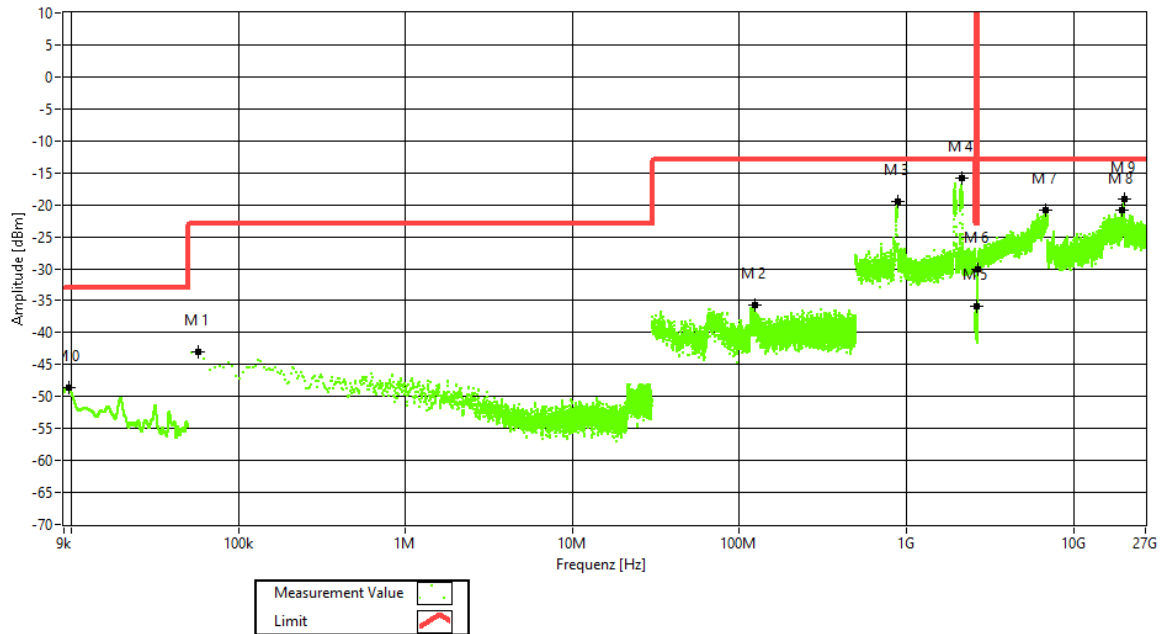


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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Frequency Band = Band 7. 2620 MHz - 2690 MHz. Test Frequency = high. Direction = RF
downlink. Signal Type = AWGN



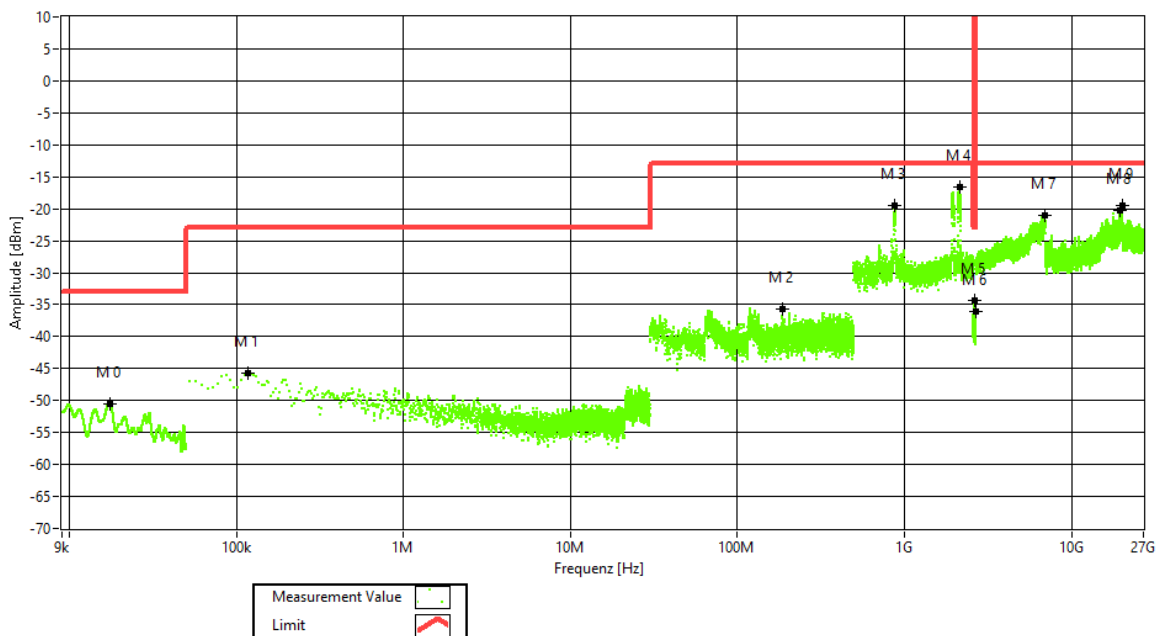


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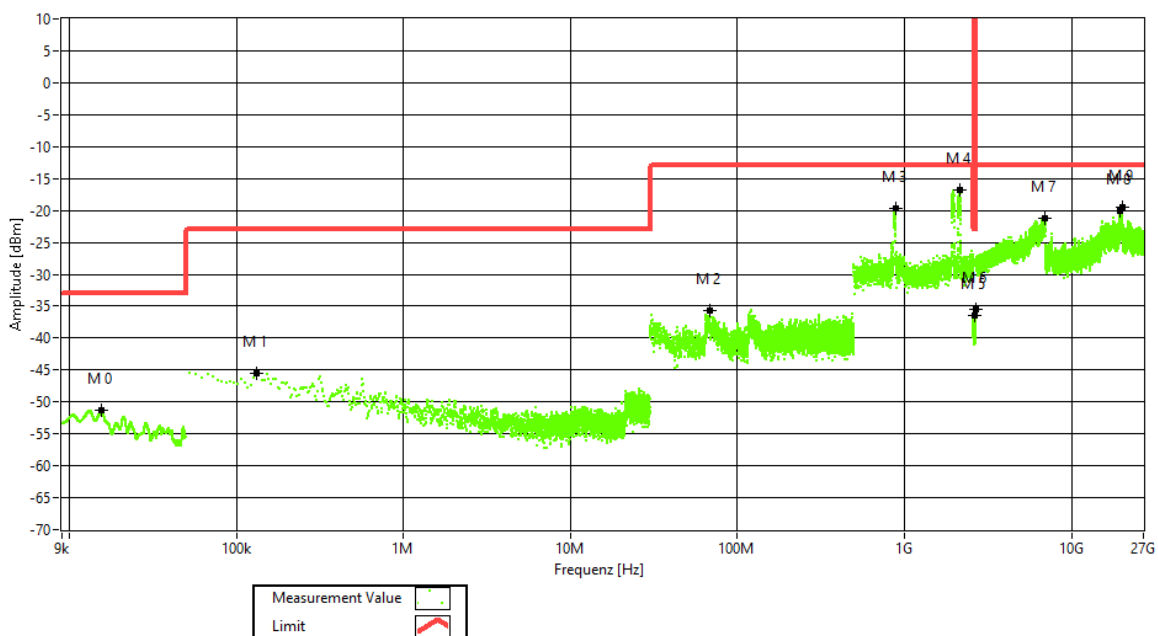
ECL-TA-20-023-V01.00

TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Frequency Band = Band 7. 2620 MHz - 2690 MHz. Test Frequency = low. Direction = RF
downlink. Signal Type = GSM



Frequency Band = Band 7. 2110MHz - 2180 MHz. Test Frequency = mid. Direction = RF
downlink. Signal Type = GSM



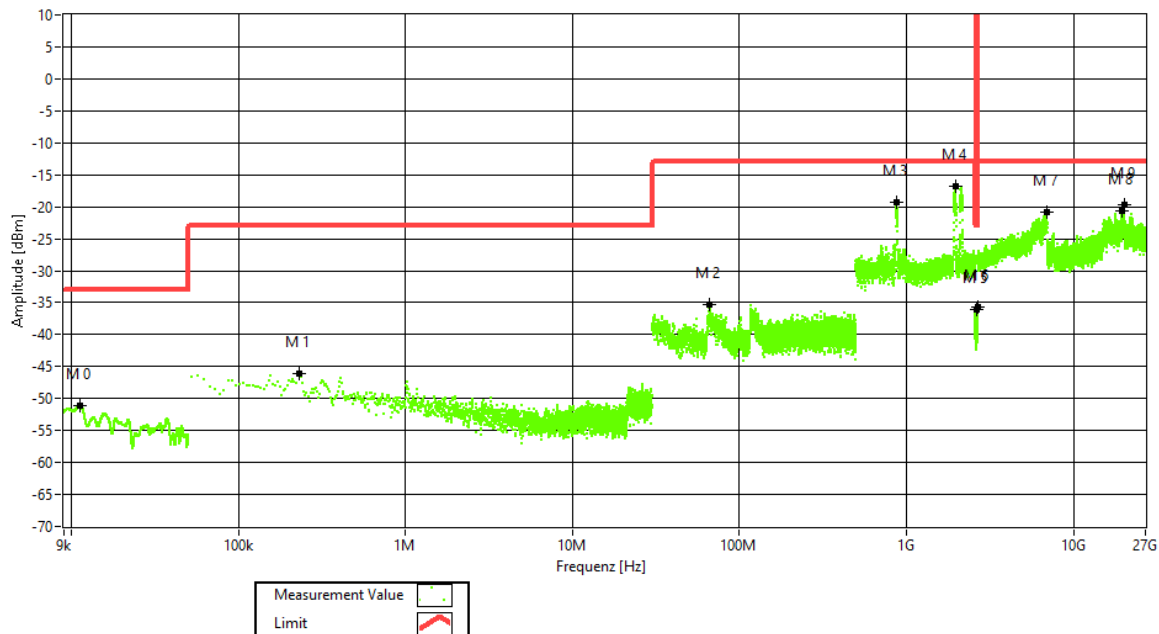


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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Frequency Band = Band 7. 2620 MHz - 2690 MHz. Test Frequency = high. Direction = RF
downlink. Signal Type = GSM



4.4.5 TEST EQUIPMENT USED

- Conducted



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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: 2020-12-16

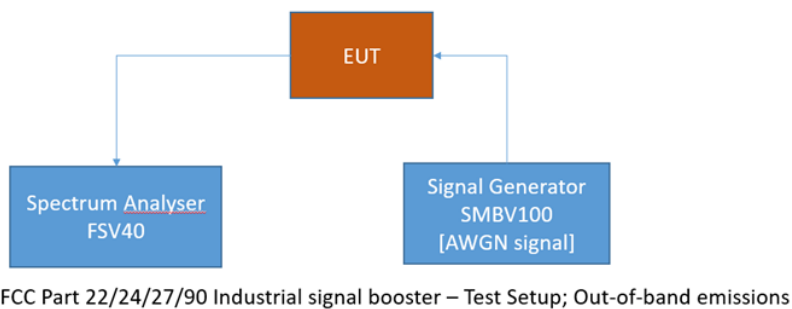
Environmental conditions: 23 ° C; 34 % r. F.

Test engineer: Thomas Gerngroß

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:



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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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 $43 + 10 \log_{10} p$.

- (i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- (ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- (iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges.

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ 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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.5.3 TEST PROTOCOL

| Band 7. 2620 MHz – 2690 MHz. 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 | 2687.50 | 6.1 | -21.9 | -13.0 | 8.9 |
| Wideband | 3 dB > AGC | upper | 2687.50 | 9.4 | -21.7 | -13.0 | 8.7 |
| Narrowband | -0.3 dB < AGC | upper | 2689.80 | 6.1 | -21.0 | -13.0 | 8.0 |
| Narrowband | 3 dB > AGC | upper | 2689.80 | 9.4 | -21.1 | -13.0 | 8.1 |
| Wideband | -0.3 dB < AGC | lower | 2622.50 | 6.5 | -21.6 | -13.0 | 8.6 |
| Wideband | 3 dB > AGC | lower | 2622.50 | 9.8 | -21.8 | -13.0 | 8.8 |
| Narrowband | -0.3 dB < AGC | lower | 2620.20 | 5.3 | -21.1 | -13.0 | 8.1 |
| Narrowband | 3 dB > AGC | lower | 2620.20 | 8.6 | -20.5 | -13.0 | 7.5 |

| Band 7. 2620 MHz – 2690 MHz. 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 | 2687.50 | 2685.00 | 6.1 | -22.1 | -13.0 | 9.1 |
| WB | 3 dB > AGC | upper | 2687.50 | 2865.00 | 9.4 | -22.1 | -13.0 | 9.1 |
| NB | -0.3 dB < AGC | upper | 2689.80 | 2689.60 | 6.1 | -23.7 | -13.0 | 10.7 |
| NB | 3 dB > AGC | upper | 2689.80 | 2689.60 | 9.4 | -22.6 | -13.0 | 9.6 |
| WB | -0.3 dB < AGC | lower | 2622.50 | 2625.00 | 6.5 | -21.7 | -13.0 | 8.7 |
| WB | 3 dB > AGC | lower | 2622.50 | 2625.00 | 9.8 | -21.9 | -13.0 | 8.9 |
| NB | -0.3 dB < AGC | lower | 2620.20 | 2620.40 | 5.3 | -23.1 | -13.0 | 10.1 |
| NB | 3 dB > AGC | lower | 2620.20 | 2620.40 | 8.6 | -23.5 | -13.0 | 10.5 |

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

Explanations concerning table with two input signals:

- “WB” means Wideband.
- “NB” means Narrowband.



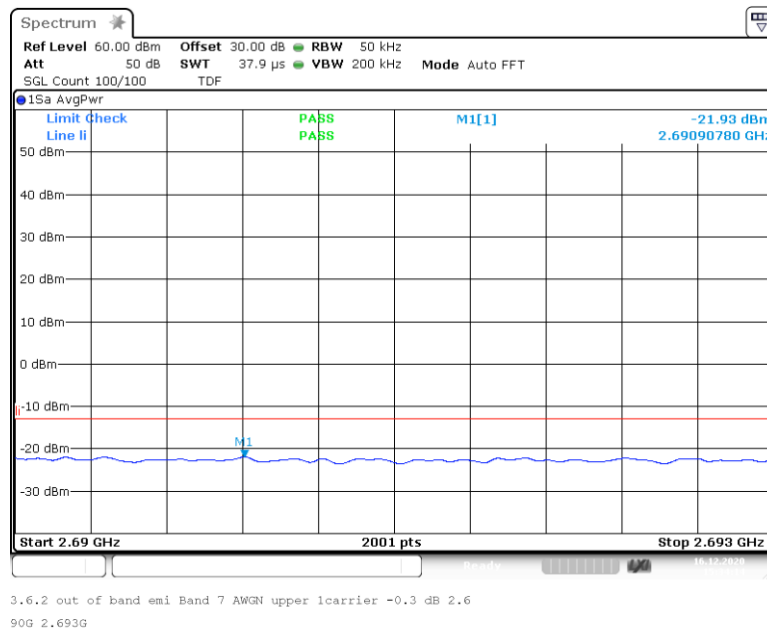
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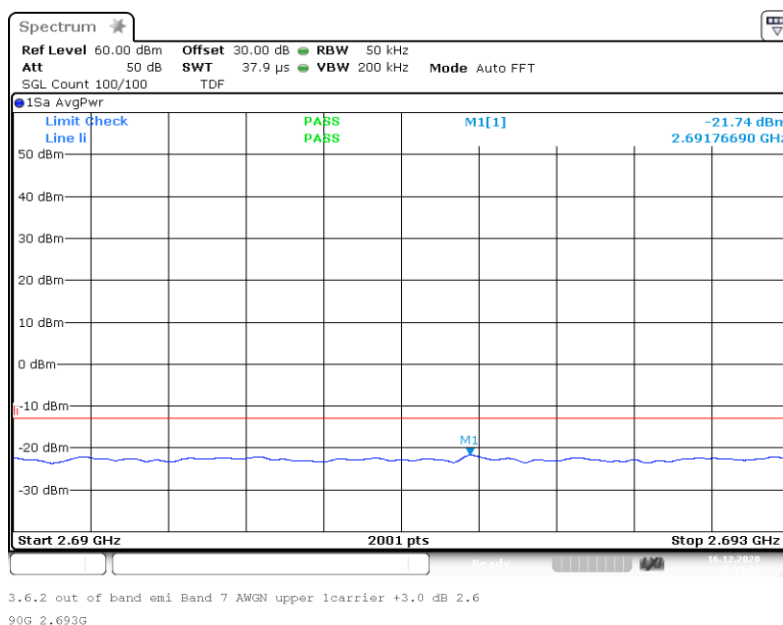
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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

Downlink: Band 7; Frequency: 2.6200 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input
Power = 0.3 dB < AGC; Number of signals 1



Downlink: Band 7; Frequency: 2.6200 GHz to 2.6900 GHz; Band Edge: upper; Mod: AWGN; Input
Power = 3 dB > AGC; Number of signals 1



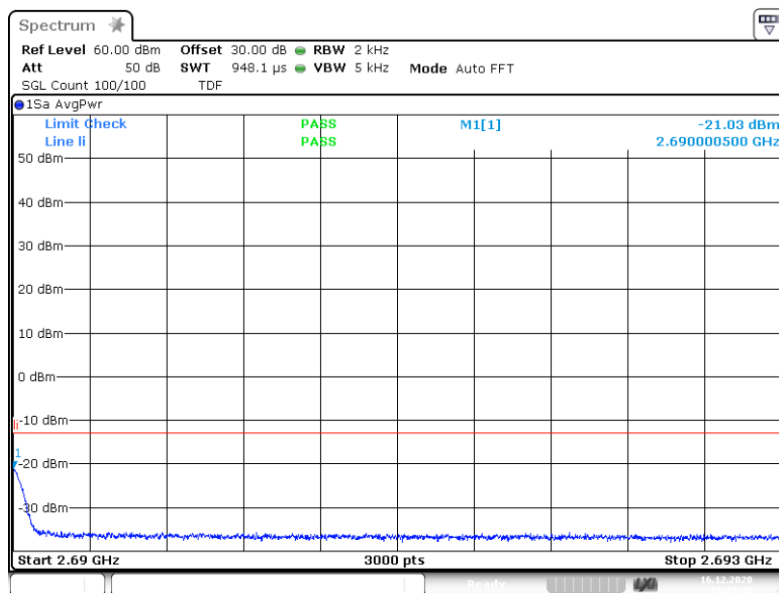


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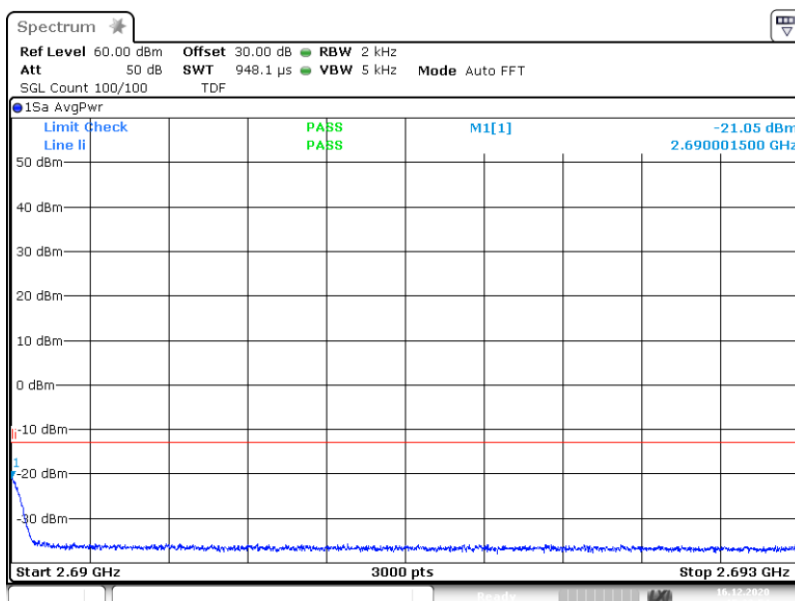
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM upper lcarrier -0.3 dB 2.69
OG 2.693G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM upper lcarrier +3.0 dB 2.69
OG 2.693G

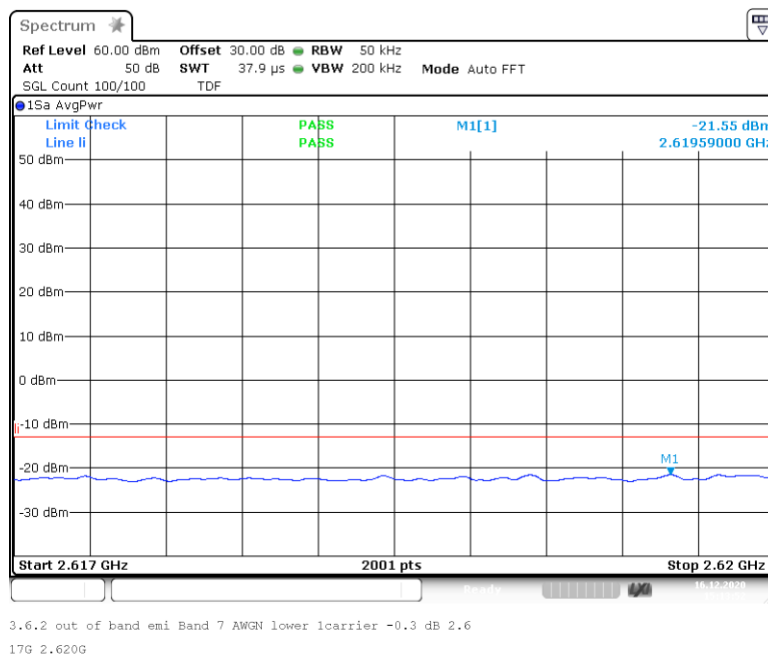


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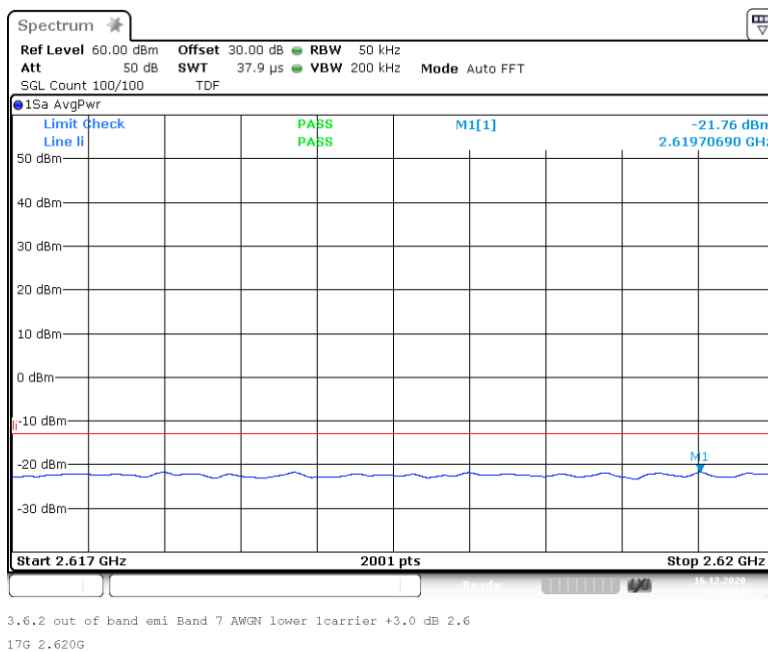
ECL-TA-20-023-V01.00

TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input
Power = 0.3 dB < AGC; Number of signals 1



Downlink: Band 7; Frequency: 2.6200 GHz to 2.6900 GHz; Band Edge: lower; Mod: AWGN; Input
Power = 3 dB > AGC; Number of signals 1



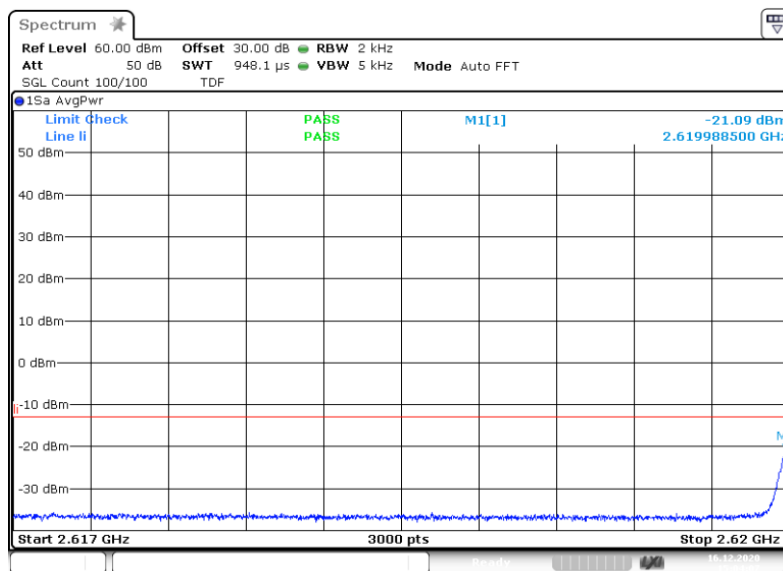


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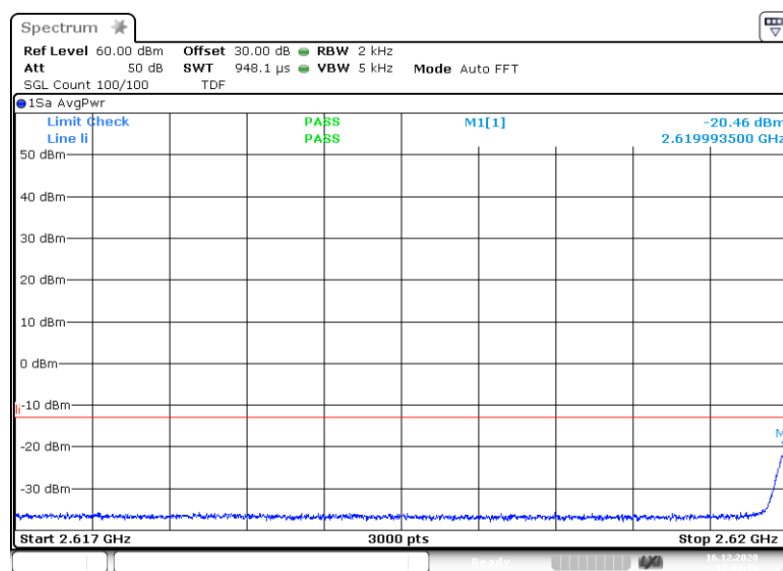
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM lower lcarrier -0.3 dB 2.61
7G 2.620G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM lower lcarrier +3.0 dB 2.61
7G 2.620G

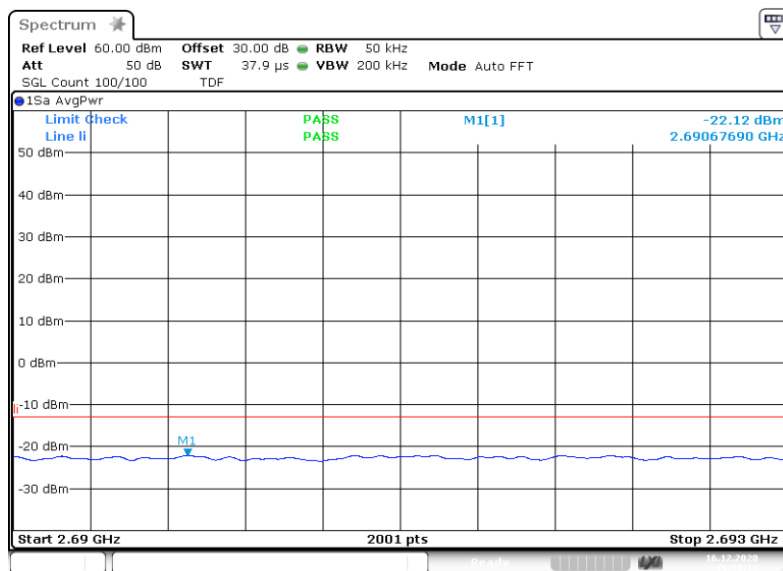


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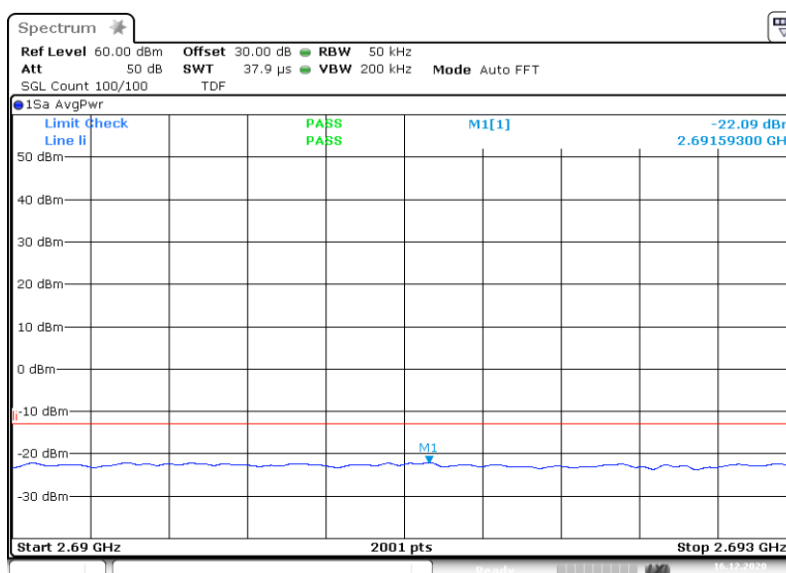
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 AWGN upper 2carriers -0.3 dB 2.
690G 2.693G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 AWGN upper 2carriers +3.0 dB 2.
690G 2.693G

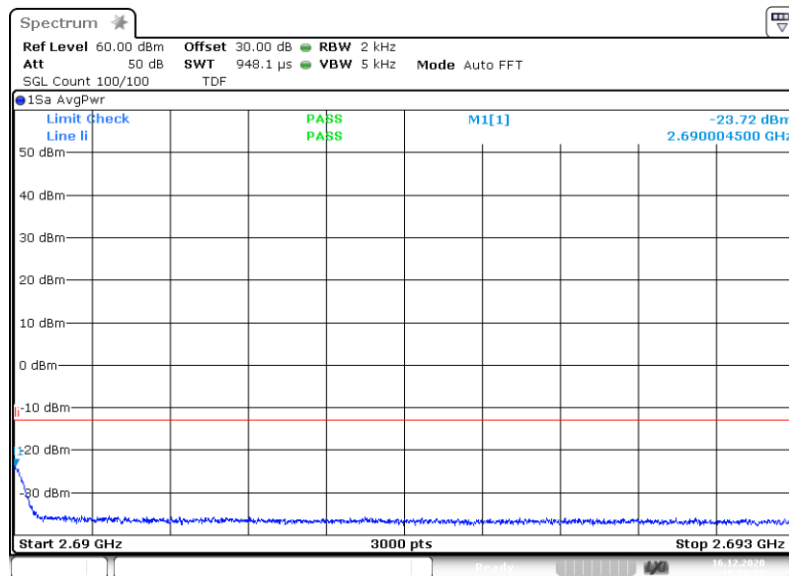


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ECL-TA-20-023-V01.00

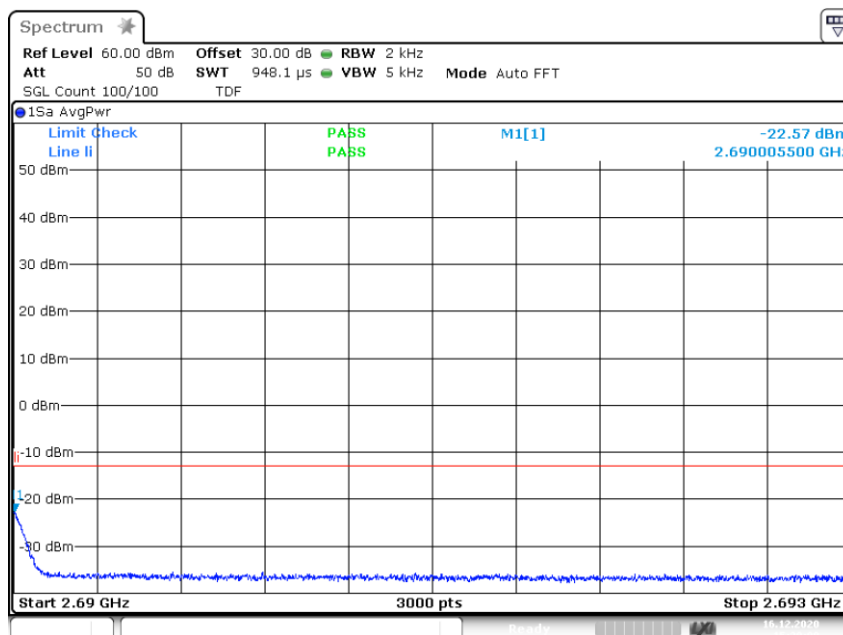
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM upper 2carriers -0.3 dB 2.6
90G 2.693G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM upper 2carriers +3.0 dB 2.6
90G 2.693G

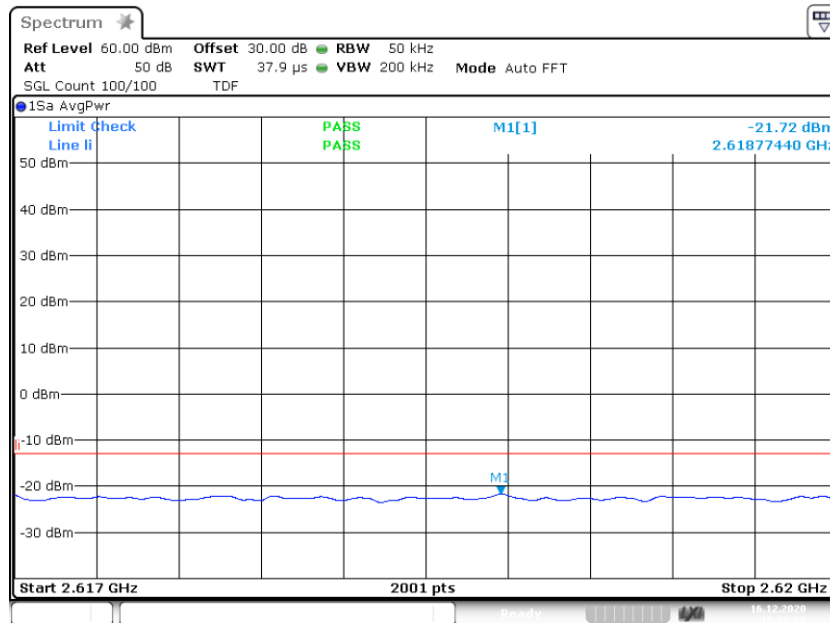


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ECL-TA-20-023-V01.00

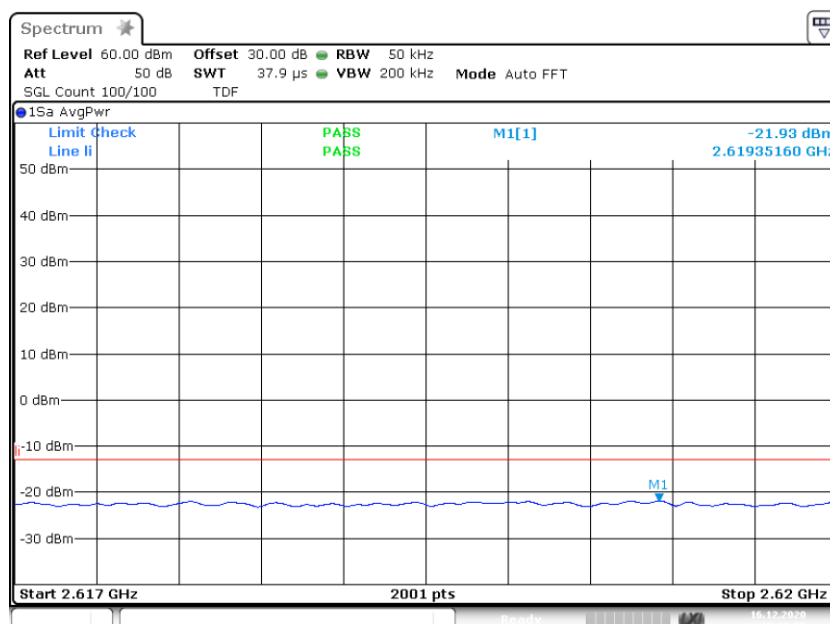
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 AWGN lower 2carriers -0.3 dB 2.
617G 2.620G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 AWGN lower 2carriers +3.0 dB 2.
617G 2.620G

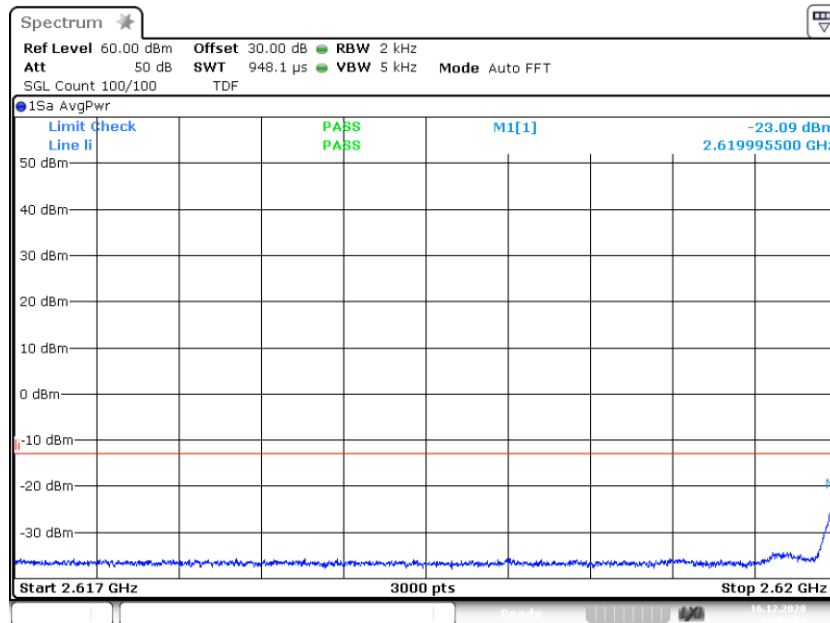


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VERITAS

ECL-TA-20-023-V01.00

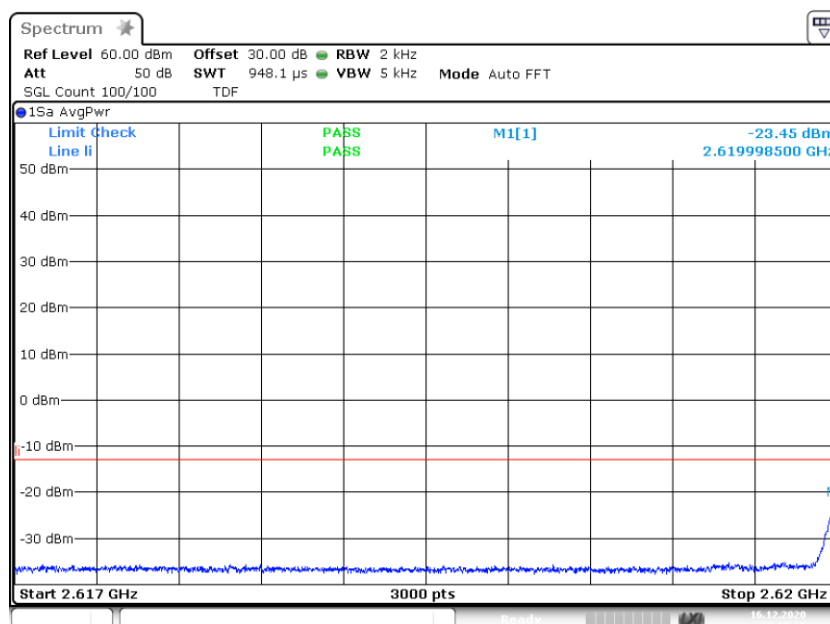
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM lower 2carriers -0.3 dB 2.6
17G 2.620G

Downlink: Band 7; Frequency: 2.6200 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 Band 7 GSM lower 2carriers +3.0 dB 2.6
17G 2.620G



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

TEST EQUIPMENT USED

- Conducted



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.6 OUT-OF-BAND REJECTION

Standard KDB 935210 D05

The test was performed according to:

ANSI C63.26; KDB 935210 D05

Test date: 2020-12-16

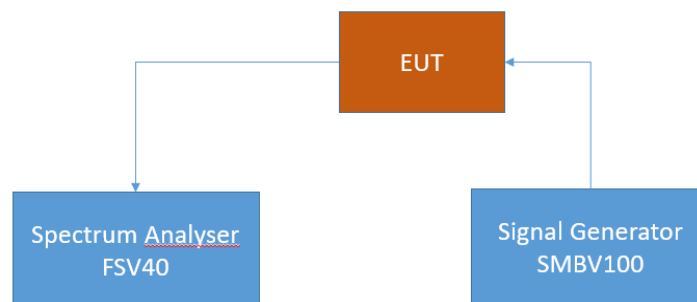
Environmental conditions: 22 ° C; 31 % r. F.

Test engineer: Thomas Gerngroß

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-F1-APE, Band 7

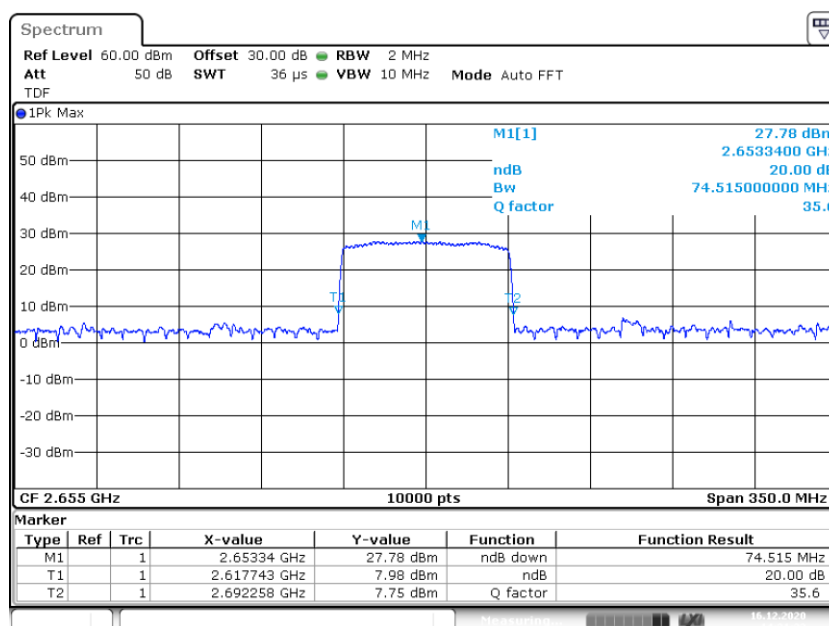
4.6.3 TEST PROTOCOL

| Band 7. 2620 MHz – 2690 MHz. 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] |
| 2653.34 | 27.78 | 2617.7430 | 2692.2580 | 74.5150 |

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

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

Frequency Band = Band SMR. 862 MHz - 869 MHz. Direction = RF downlink



3.3 Out of band rejection Band 7 2.65500G
_20dB

4.6.5 TEST EQUIPMENT USED

- Conducted

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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.7 FIELD STRENGTH OF SPURIOUS RADIATION

Standard FCC Part § 2.1053. § 27.53

The test was performed according to:
ANSI C63.26

Test date: 2020-12-18; 2020-12-19

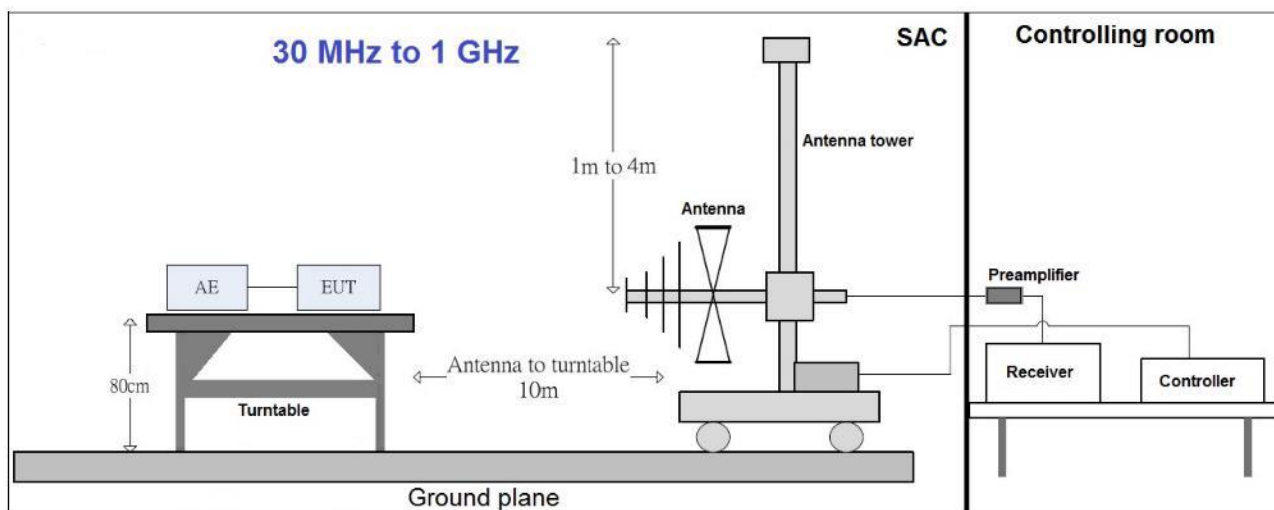
Environmental conditions: 20 ° C; 40 % r. F.

Test engineer: Thomas Hufnagel

4.7.1 TEST DESCRIPTION

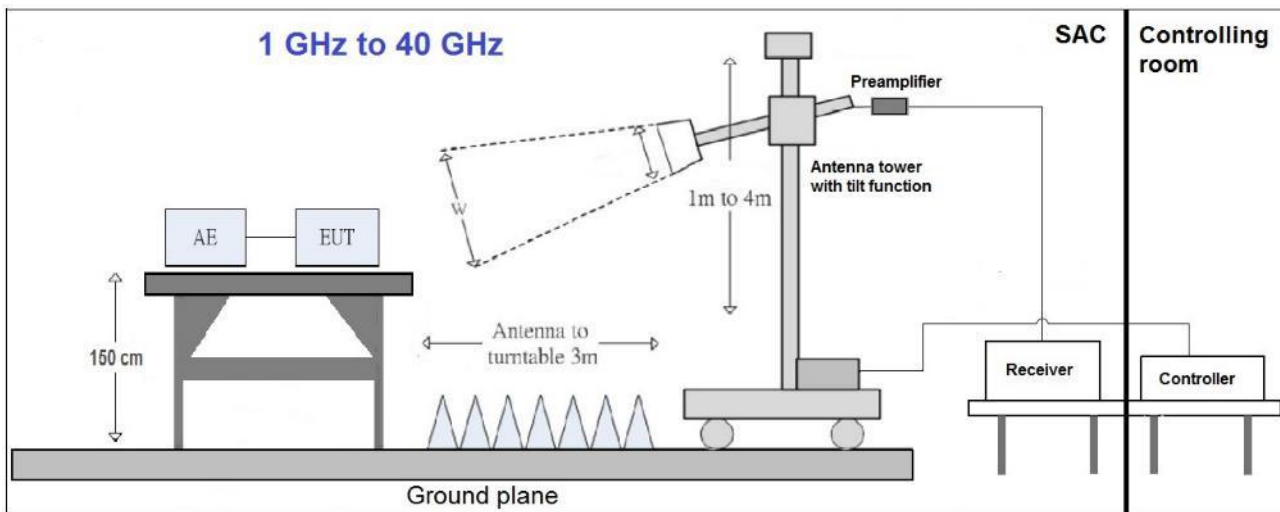
This test case is intended to demonstrate compliance to the applicable radiated spurious emission measurements per FCC § 2.1053. FCC § 27.53 and RSS-199 with subpart 4.5.

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



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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1. Measurement above 30 MHz and up to 1 GHz

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. ?

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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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 $\pm 45^\circ$ 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: $\pm 30^\circ$ 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 ($h = 1 \dots 4$ m) with an additional tilt function of the antenna. The turn table azimuth will slowly vary by $\pm 15^\circ$.

EMI receiver settings (for all steps):

- Detector: Peak, Average
- IF Bandwidth = 1 MHz



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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 $43 + 10 \log_{10} p$.

- (i) $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- (ii) $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- (iii) $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges.

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ 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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

4.7.3 TEST PROTOCOL

30 MHz to 1 GHz:

| Band 7. 2620 MHz – 2690 MHz. downlink; | | | | | | |
|---|-----------------------------|------------------------------|-----------------|------------------|--------------------|-----------------------------|
| Spurious Freq. [MHz] | Spurious Level [dBm] | Pin (Sum Level) [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| 70.4 | -67.0 | 5.2 | PEAK | 120 | -13.0 | 54.0 |
| 200.0 | -68.3 | 5.2 | PEAK | 120 | -13.0 | 55.3 |
| 208.4 | -65.2 | 5.2 | PEAK | 120 | -13.0 | 52.2 |
| 400.0 | -67.8 | 5.2 | PEAK | 120 | -13.0 | 54.8 |
| 192.2 | -74.4 | 5.2 | PEAK | 120 | -13.0 | 61.4 |
| 200.0 | -77.1 | 5.2 | PEAK | 120 | -13.0 | 64.1 |

Above 1 GHz to 18 GHz:

| Band 7. 2620 MHz – 2690 MHz. downlink; | | | | | | |
|---|-----------------------------|------------------------------|-----------------|------------------|--------------------|-----------------------------|
| Spurious Freq. [MHz] | Spurious Level [dBm] | Pin (Sum Level) [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| 2620.1 | -38.8 | 5.2 | PEAK | 1000 | -13.0 | 25.8 |
| 3555.7 | -42.0 | 5.2 | PEAK | 1000 | -13.0 | 29.0 |
| 17802.2 | -19.0 | 5.2 | PEAK | 1000 | -13.0 | 6.0 |
| 2654.7 | -40.5 | 5.2 | PEAK | 1000 | -13.0 | 27.5 |
| 9952.2 | -27.5 | 5.2 | PEAK | 1000 | -13.0 | 14.5 |
| 17735.4 | -20.2 | 5.2 | PEAK | 1000 | -13.0 | 7.2 |



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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Above 18 GHz to 27 GHz:

| Band 7. 2620 MHz – 2690 MHz. downlink; | | | | | | |
|---|-------------------------------------|--------------------------------------|-----------------|----------------------|------------------------|-------------------------------------|
| Spurious Freq. [MHz] | Spurious Level [dBm] | Pin (Sum Level) [dBm] | Detector | RBW [kHz] | Limit [dBm] | Margin to Limit [dB] |
| 20625.0 | -50.0 | 5.2 | PEAK | 1000 | -13.0 | 37.0 |
| 20625.0 | -51.9 | 5.2 | PEAK | 1000 | -13.0 | 38.9 |

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

Although usually a RMS detector is used for measurements in this case 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 definitely also in tolerance.



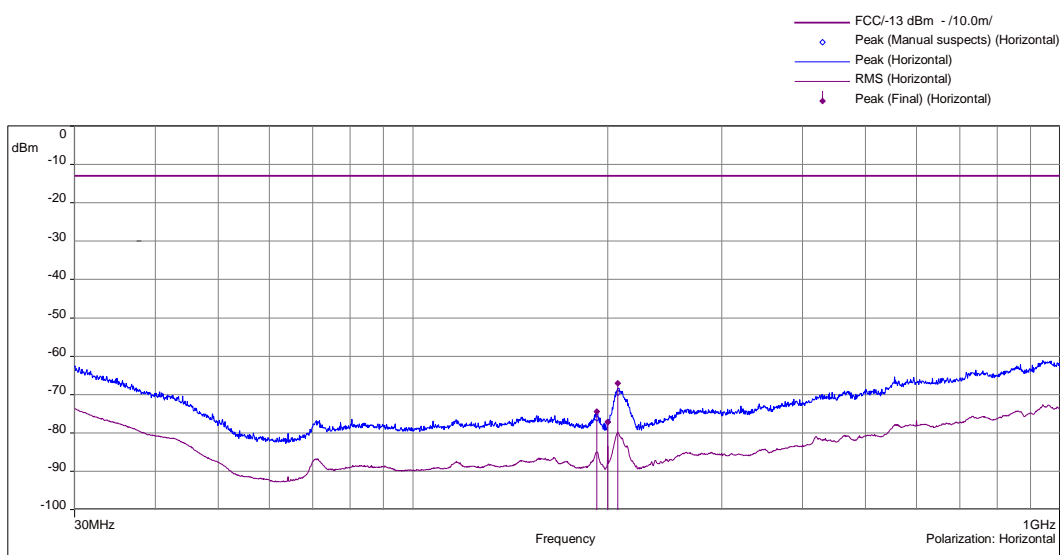
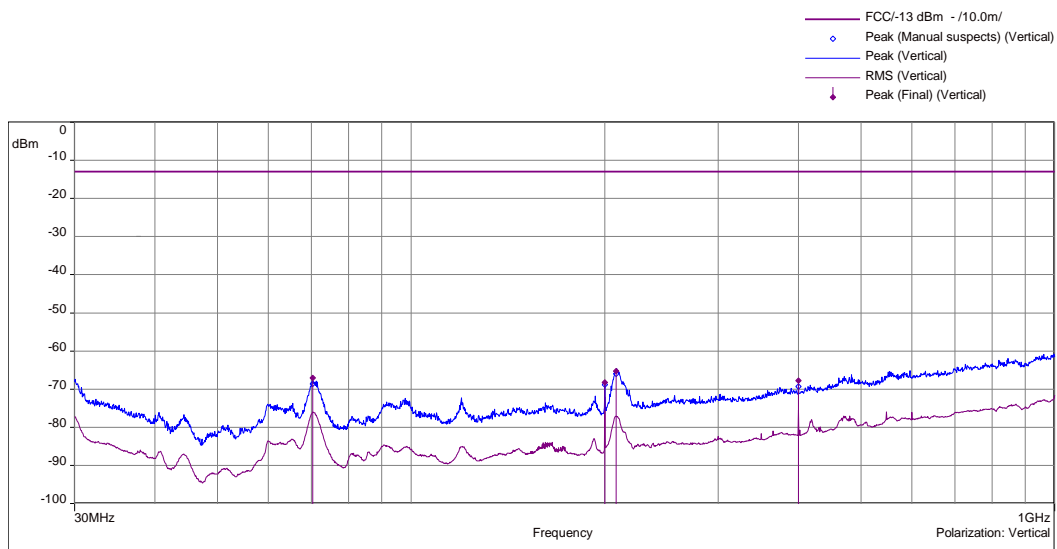
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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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

Frequency Band = Band 7, 2620 MHz - 2690 MHz. Test Frequency = low. Direction = RF
downlink

30 MHz - 1 GHz



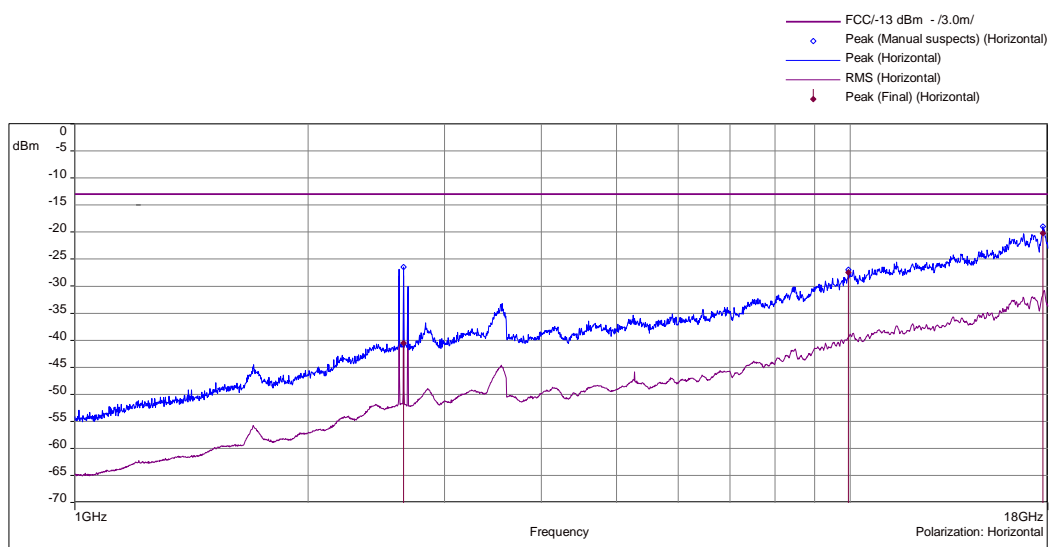
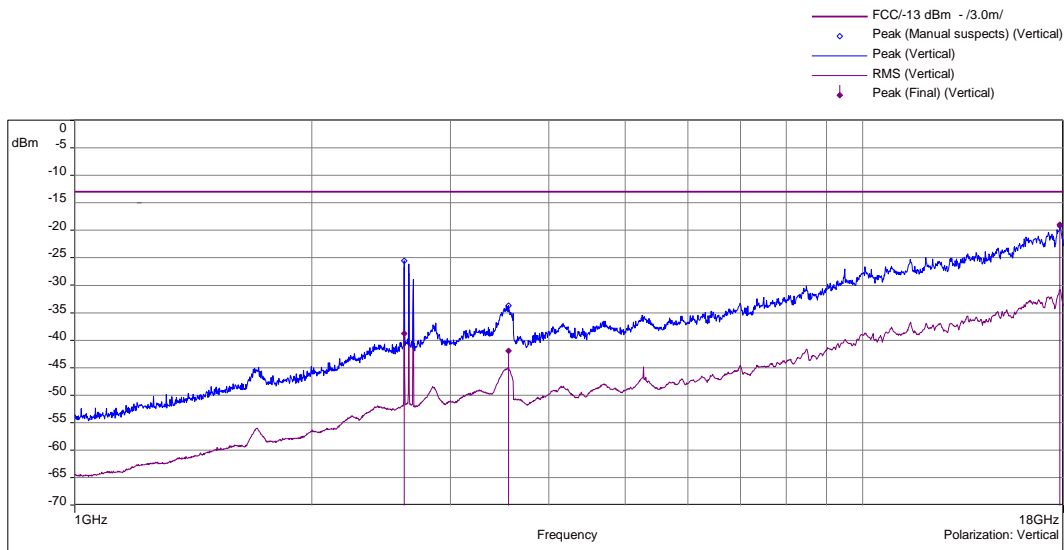


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VERITAS

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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

1 GHz - 18 GHz





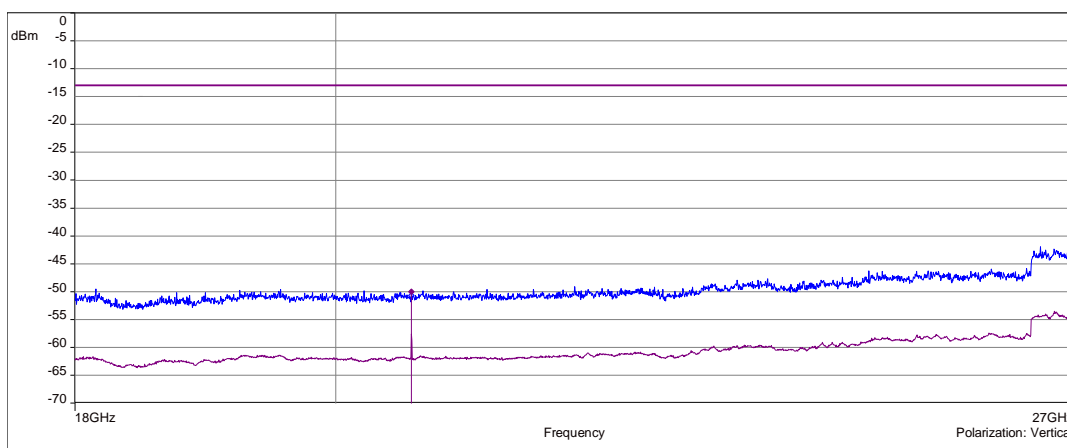
BUREAU
VERITAS

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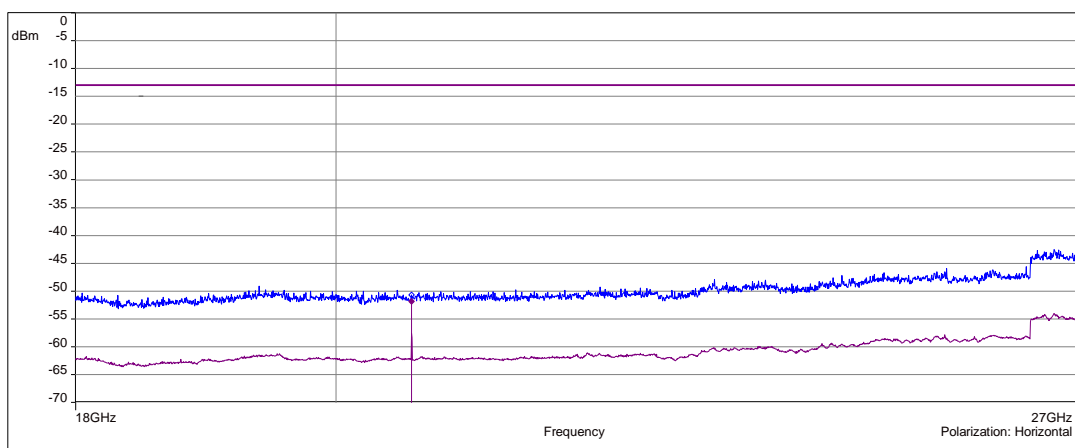
TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

18 GHz - 27 GHz

- FCC/-13 dBm - /3.0m/
- Peak (Manual suspects) (Vertical)
- Peak (Vertical)
- RMS (Vertical)
- Peak (Final) (Vertical)



- FCC/-13 dBm - /3.0m/
- Peak (Manual suspects) (Horizontal)
- Peak (Horizontal)
- RMS (Horizontal)
- Peak (Final) (Horizontal)





**BUREAU
VERITAS**

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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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4.7.5 FIELD STRENGTH CALCULATIONS

$$\mathbf{FS} = \mathbf{SA} + \mathbf{AF} + \mathbf{CL} + \mathbf{PA}$$

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



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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 | 2020-12 | 2021-12 |
| 1.2 | SMBV100A | Vector Signal Generator 9 kHz - 6 GHz | Rohde & Schwarz | G2089 | 2020-08 | 2022-08 |
| 1.3 | KlimaLogg Pro | Thermo-Hygrometer | TFA | X546 | 2020-05 | 2021-05 |

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 | 2020-12 | 2021-12 |
| 2.2 | SMBV100A | Vector Signal Generator 9 kHz - 6 GHz | Rohde & Schwarz | G2089 | 2020-08 | 2022-08 |
| 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 | 2022-10 |
| 2.6 | AM1431 | Pre amplifier 10 kHz - 1 GHz | Miteq | K1721 | 2020-12 | 2021-12 |
| 2.7 | AFS4-00102000 | Preamplifier 100 MHz - 20 GHz | Miteq | K838 | 2010-12 | 2021-12 |
| 2.8 | JS43-1800-4000 | Preamplifier 18 GHz - 40 GHz | Miteq | K1104 | 2019-05 | 2021-10 |
| 2.9 | 30.3015 | ThermoHygro Datalogger | TFA | X 507 | 2018-08 | 2021-08 |
| 2.10 | BAT-EMC | Software | Nexio | V3.20.0.10 | --- | --- |



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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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

$$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-20 * \text{LOG} (d_{\text{Limit}}/ d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
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6.2 ANTENNA ROHDE & SCHWARZ HL 025 (1 GHZ – 18 GHZ)

| Frequency | AF R&S HL 025 | Corr. |
|-----------|------------------|-------|
| MHz | dB (1/m) | dB |
| 1000 | 33.2 | -18.9 |
| 2000 | 39.4 | -17.8 |
| 3000 | 42.8 | -17.0 |
| 4000 | 45.1 | -16.6 |
| 5000 | 46.8 | -16.6 |
| 6000 | 48.5 | -16.7 |
| 7000 | 50.2 | -16.2 |
| 8000 | 50.4 | -15.3 |
| 9000 | 51.9 | -14.4 |
| 10000 | 53.8 | -14.0 |
| 11000 | 54.5 | -14.1 |
| 12000 | 55.3 | -14.4 |
| 13000 | 55.7 | -14.7 |
| 14000 | 56.5 | -14.8 |
| 15000 | 56.4 | -14.7 |
| 16000 | 57.2 | -14.3 |
| 17000 | 57.6 | -14.5 |
| 18000 | 57.6 | -14.6 |

| pre-amp | cable loss (to receiver) |
|---------|-----------------------------|
| dB | dB |
| -20.92 | 2.01 |
| -20.60 | 2.78 |
| -20.44 | 3.42 |
| -20.58 | 3.99 |
| -21.08 | 4.46 |
| -21.53 | 4.87 |
| -21.53 | 5.35 |
| -20.97 | 5.66 |
| -20.44 | 6.05 |
| -20.43 | 6.45 |
| -20.84 | 6.69 |
| -21.41 | 7.04 |
| -22.09 | 7.36 |
| -22.48 | 7.66 |
| -22.56 | 7.90 |
| -22.49 | 8.20 |
| -22.90 | 8.45 |
| -23.27 | 8.71 |

Sample calculation

$$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$$

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.



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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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 | Corr. |
|-----------|--------------------------|-------|
| MHz | EMCO 3160-09 dB (1/m) | dB |
| 18000 | 44.3 | -37.5 |
| 18500 | 43.9 | -37.6 |
| 19000 | 44.4 | -36.9 |
| 19500 | 44.1 | -36.1 |
| 20000 | 44.6 | -36.3 |
| 20500 | 44.9 | -36.1 |
| 21000 | 45.2 | -35.9 |
| 21500 | 45.0 | -35.7 |
| 22000 | 45.1 | -35.3 |
| 22500 | 45.4 | -35.0 |
| 23000 | 45.7 | -35.6 |
| 23500 | 45.8 | -34.3 |
| 24000 | 45.3 | -34.8 |
| 24500 | 45.3 | -35.0 |
| 25000 | 46.1 | -34.3 |
| 25500 | 46.5 | -34.2 |
| 26000 | 46.7 | -34.8 |
| 26500 | 46.5 | -34.4 |
| 27000 | 46.4 | -35.1 |

| pre-amp | cable loss (to receiver) |
|---------|-----------------------------|
| dB | dB |
| -46.2 | 8.7 |
| -46.4 | 8.8 |
| -45.9 | 9.0 |
| -45.2 | 9.1 |
| -45.6 | 9.3 |
| -45.5 | 9.4 |
| -45.3 | 9.4 |
| -45.3 | 9.7 |
| -45.1 | 9.8 |
| -44.8 | 9.8 |
| -45.5 | 9.9 |
| -44.4 | 10.1 |
| -45.0 | 10.2 |
| -45.3 | 10.4 |
| -44.8 | 10.5 |
| -44.7 | 10.5 |
| -45.4 | 10.6 |
| -45.1 | 10.7 |
| -46.0 | 10.9 |

Sample calculation

$$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + \text{AF (dB 1/m)} + \text{Corr. (dB)}$$

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.



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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 measurements | 5.38 dB |
| Total frequency uncertainty | 2×10^{-7} |

Reference :

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



**BUREAU
VERITAS**

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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>



**BUREAU
VERITAS**

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ANNEX B: ADDITIONAL INFORMATION PROVIDED BY CLIENT

None.

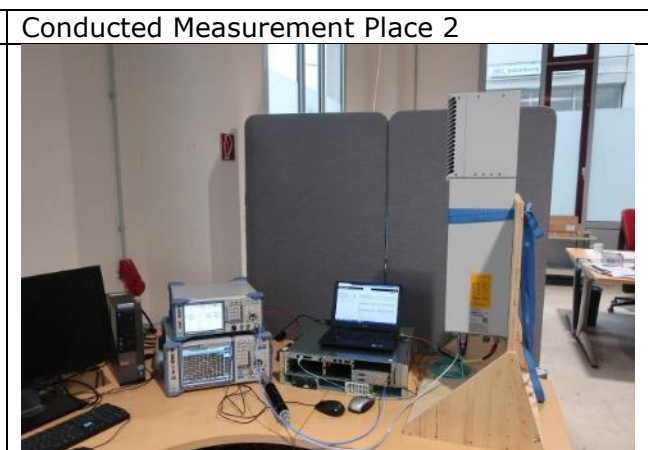
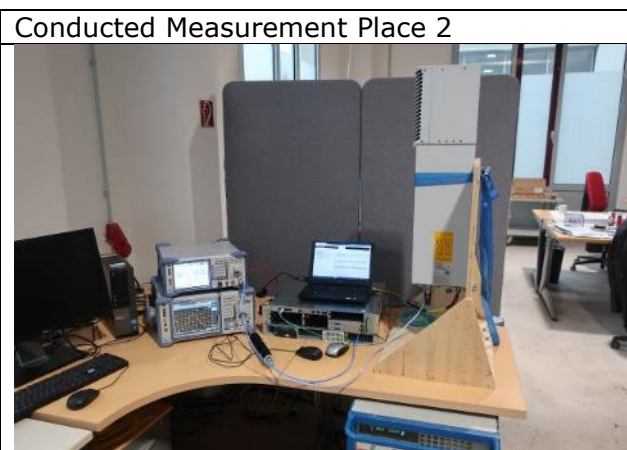
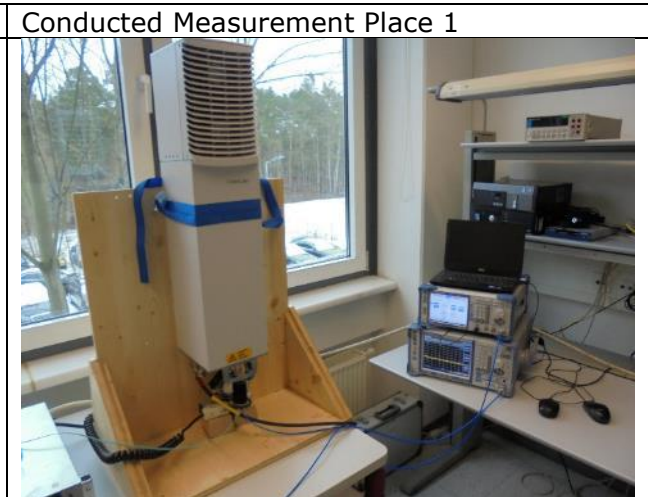
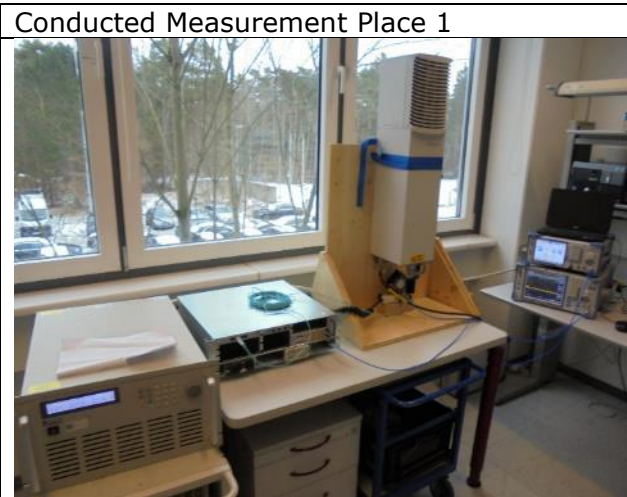


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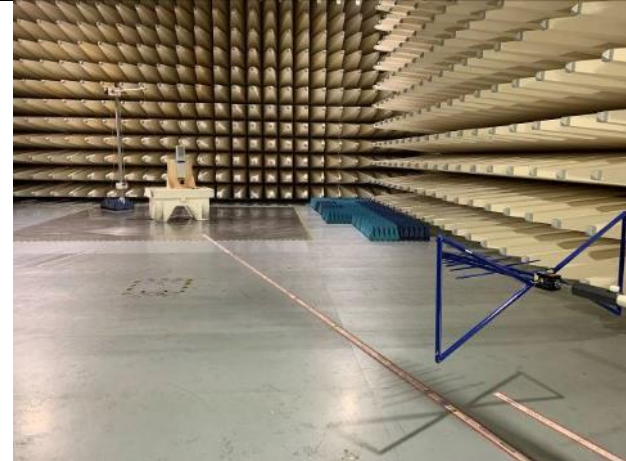
ANNEX C: PHOTO REPORT



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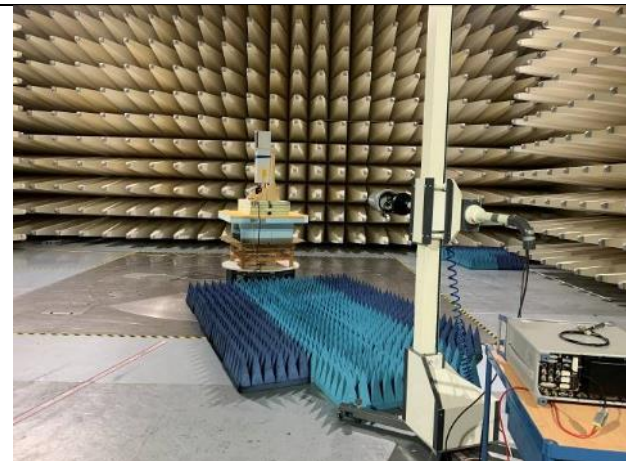
Radiated Measurement 30 MHz up to 1 GHz



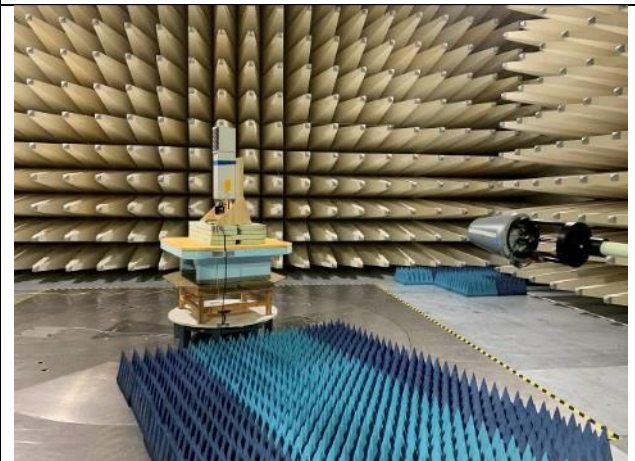
Radiated Measurement 30 MHz up to 1 GHz



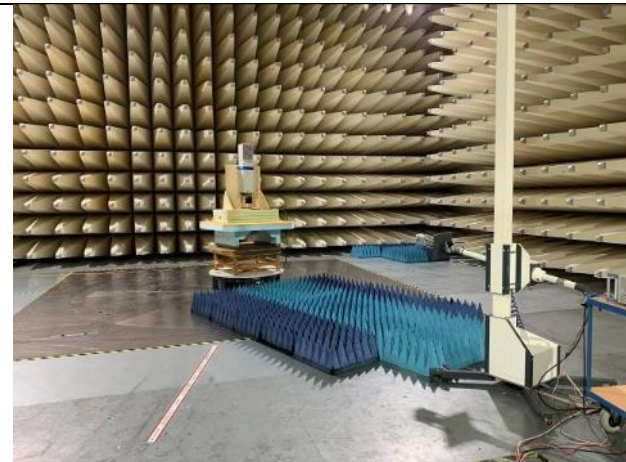
Radiated Measurement over 1 GHz up to 18 GHz



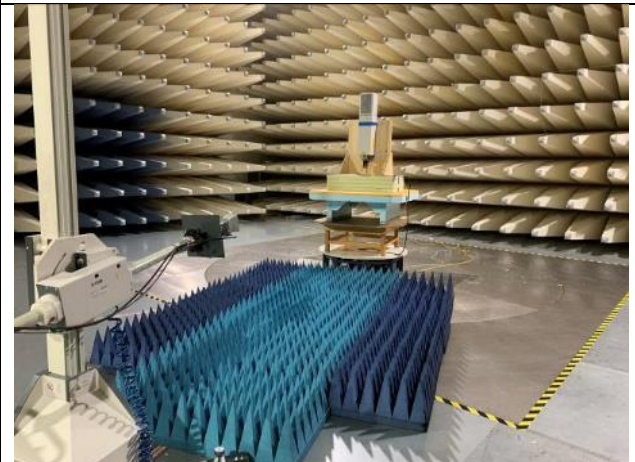
Radiated Measurement over 1 GHz up to 18 GHz



Radiated Measurement over 18 GHz up to 27 GHz



Radiated Measurement over 18 GHz up to 27 GHz





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TA tests on Andrew, CAP H 80-85_17E_19_26 F-AC-
F1-APE, Band 7

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