

ISED CABid: ES1909

Test Report No:  
NIE: 68001RRF.008

## Partial Test Report

Reference Standard:  
USA FCC Part 22  
CANADA RSS-132

|                                           |                                                                                                                                                                                                                                                  |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (*) Identification of item tested         | Telematic control unit with wireless technologies, used in automotive industry                                                                                                                                                                   |
| (*) Trademark                             | BMW                                                                                                                                                                                                                                              |
| (*) Model and /or type reference          | WAVE-11-HAF-R2                                                                                                                                                                                                                                   |
| (*) Derived model not tested              | WAVE-11-HIGH-R2                                                                                                                                                                                                                                  |
| Other identification of the product       | Type: B424<br>HW version: D5<br>SW version: 21411A.004_045_017<br>IMEI TAC: 35011736 (OEM modem), 35894272 (CUS modem)<br>Contains FCC ID: T8GSAN9000<br>Contains FCC ID: T8GSAN9001<br>Contains IC: 6434A-SAN9000<br>Contains IC: 6434A-SAN9001 |
| (*) Features                              | GSM, UMTS, LTE, 5G, GNSS                                                                                                                                                                                                                         |
| Applicant                                 | HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH<br>BECKER-GOERING-STR. 16; 76307 KARLSBAD,<br>GERMANY                                                                                                                                                      |
| Test method requested, standard           | USA FCC Part 22 (10-1-20 Edition).<br>CANADA RSS-132 Issue 3, January 2013.<br>- Radiated Emissions.<br>ANSI C63.26-2015.<br>KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.                                              |
| Approved by (name / position & signature) | Rafael López Martín<br>EMC Consumer & RF Lab. Manager  2022.01.11<br>16:43:18<br>+01'00'                                                                    |
| Date of issue                             | 2022-01-11                                                                                                                                                                                                                                       |
| Report template No                        | FDT08_23<br>(*) "Data provided by the client"                                                                                                                                                                                                    |

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## Competences and guarantees

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DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, with the appropriate scope of accreditation that covers the performed tests in this report.

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## General conditions

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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## Uncertainty

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Uncertainty (factor  $k=2$ ) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

## Data provided by the client

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The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model WAVE-11-HAF-R2 is a Telematics control unit with wireless technologies, used in automotive, equipped with 2 modems, OEM and customer. The project name WAVE has the meaning "Wireless Access in Vehicular Environment" and thus describes the key features of this device as Communication and Data Interface. This unit was designed for automotive usage and contains the following features: GSM, UMTS, LTE, 5G, and GNSS.

3. Derived model not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

**HARMAN AUTOMOTIVE DIVISION**  
HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH  
BECKER-GÖRING-STRASSE 16  
76307 KARLSBAD, GERMANY



### Declaration of similarity

To whom it may concern,

We, **Harman Becker Automotive Systems GmbH,** located in  
**Becker-Goering-Str. 16; 76307 Karlsbad, Germany**

Hereby declare that the following units: **WAVE-11-HIGH-R2** and **WAVE-11-HAF-R2** have integrated the same NAD modules, are using same schematic and same PCB layout.

The only difference between the two models is that **WAVE-11-HIGH-R2** is equipped with chipset U-Blox UBX-F9940, where **WAVE-11-HAF-R2** is equipped with chipset ST-Micro STA9100MGA & STA5635S.

Where only one of the aforementioned variants has been used as DUT, shall remain valid and applicable for these two models described.

This declaration is intended to be included in the test reports where applies

Regards



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DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

| Control N° | Description                                                                                   | Model          | Serial N°       | Date of reception |
|------------|-----------------------------------------------------------------------------------------------|----------------|-----------------|-------------------|
| 68001/012  | Telematic control unit with wireless technologies, used in automotive industry<br>(Type B424) | WAVE-11-HAF-R2 | B425G40M4907018 | 2021/08/10        |
| 68000C/083 | Antenna (DA WAVE HIGH US 5G ROW)                                                              | DA05DI20       | --              | 2021/08/27        |
| 62486/024  | Antenna Box                                                                                   | AB01-I20-01    | --              | 2020/09/22        |
| 62486/027  | Antenna Box                                                                                   | AB01-I20-01    | --              | 2020/09/22        |
| 68000C/067 | Spoiler Antenna ZB G05/G07                                                                    | --             | 0014            | 2021/07/29        |
| 62486/025  | Antenna Box                                                                                   | AB01-I20-01    | --              | 2020/09/22        |
| 62486/062  | RF Harness                                                                                    | --             | --              | 2020/09/22        |

Auxiliary elements used with the Sample S/01:

| Control N° | Description                    | Model  | Serial N° | Date of reception |
|------------|--------------------------------|--------|-----------|-------------------|
| 68000C/009 | Battery                        | 607492 | --        | 2021/07/29        |
| 62486/048  | RF Cable for 4-Fakra           | --     | --        | 2020/09/22        |
| 62486/055  | OABR Cable                     | --     | --        | 2020/09/22        |
| 62486/047  | RF Cable for 4-Fakra           | --     | --        | 2020/09/22        |
| 62486/162  | OABR 1000 BaseT Converter      | --     | --        | 2020/09/28        |
| 62486/156  | OABR Cable Adapter             | --     | --        | 2020/09/28        |
| 62486/101  | SOS Button (E-Call)            | 9385   | 11221     | 2020/09/28        |
| 62486/042  | Antenna ground planes for roof | --     | --        | 2020/09/22        |

Sample S/01 has undergone the following test(s): The Radiated tests indicated in the Appendix A.

## Test sample description

|                                               |                                         |                                                                                                    |                                     |                                     |                                   |
|-----------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|
| Ports.....:                                   | Port name and description               | Cable                                                                                              |                                     |                                     |                                   |
|                                               |                                         | Specified max length [m]                                                                           | Attached during test                | Shielded                            | Coupled to patient <sup>(3)</sup> |
|                                               | RF connector –code D violet trunk/roof) | Port not used for SOP2021 (it has V2X interfaces and gateway for SDARS signal towards another ECU) | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>          |
|                                               | RF connector – code C blue (trunk/roof) | >5m                                                                                                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>          |
|                                               | NanoMQS 20pol                           | >5m                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>          |
|                                               | NanoMQS 10pol                           | >8m                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>          |
|                                               | HDBT MATenet 2-Pol (Roof/Trunk)         | >5m                                                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>          |
| Antenna Connector grey (Roof)                 | <0.5m                                   | <input checked="" type="checkbox"/>                                                                | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                   |
| Supplementary information to the ports.....:  | -                                       |                                                                                                    |                                     |                                     |                                   |
| Rated power supply .....                      | Voltage and Frequency                   |                                                                                                    |                                     |                                     |                                   |
|                                               | <input checked="" type="checkbox"/>     | DC: 12V car battery / attenuator (4,5 V ≤ UB ≤ 18 V; UB typical: 12 V)                             |                                     |                                     |                                   |
| Rated Power.....:                             | 12V DC                                  |                                                                                                    |                                     |                                     |                                   |
| Clock frequencies.....:                       | 25MHz;26MHz;32,768kHz;49,58MHz;         |                                                                                                    |                                     |                                     |                                   |
| Other parameters .....                        | See Technical description               |                                                                                                    |                                     |                                     |                                   |
| Software version.....:                        | 21411A.004_045_017                      |                                                                                                    |                                     |                                     |                                   |
| Hardware version .....                        | D5                                      |                                                                                                    |                                     |                                     |                                   |
| Dimensions in cm (W x H x D) ...:             | 160x18x112 mm                           |                                                                                                    |                                     |                                     |                                   |
| Mounting position .....                       | <input type="checkbox"/>                | Table top equipment                                                                                |                                     |                                     |                                   |
|                                               | <input type="checkbox"/>                | Wall/Ceiling mounted equipment                                                                     |                                     |                                     |                                   |
|                                               | <input type="checkbox"/>                | Floor standing equipment                                                                           |                                     |                                     |                                   |
|                                               | <input type="checkbox"/>                | Hand-held equipment                                                                                |                                     |                                     |                                   |
|                                               | <input checked="" type="checkbox"/>     | Other: automotive telematics control unit                                                          |                                     |                                     |                                   |
| Modules/parts.....:                           | Module/parts of test item               |                                                                                                    | Type                                | Manufacturer                        |                                   |
|                                               | -                                       |                                                                                                    |                                     |                                     |                                   |
| Accessories (not part of the test item) ..... | Description                             |                                                                                                    | Type                                | Manufacturer                        |                                   |
|                                               | Cable Harness                           |                                                                                                    | -                                   |                                     |                                   |
|                                               | 2G/3G4G/5G Antenna                      |                                                                                                    | -                                   | Hirschmann/Molex                    |                                   |
|                                               | E-CALL button/LED                       |                                                                                                    | -                                   |                                     |                                   |
|                                               | SOS Loudspeaker                         |                                                                                                    | -                                   |                                     |                                   |

|                                              |                       |           |            |
|----------------------------------------------|-----------------------|-----------|------------|
|                                              | Wake-up unit Box      | -         |            |
| Documents as provided by the applicant ..... | Description           | File name | Issue date |
|                                              | Technical Description |           |            |

<sup>(3)</sup> Only for Medical Equipment

## Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH  
BECKER-GOERING-STR. 16, 76307 KARLSBAD, GERMANY

## Testing period and place

|               |                                        |
|---------------|----------------------------------------|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start)  | 2021-11-09                             |
| Date (finish) | 2021-11-09                             |

## Document history

| Report number | Date       | Description    |
|---------------|------------|----------------|
| 68001RRF.008  | 2022-01-11 | First release. |

## Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

In the semianechoic chamber, the following limits were not exceeded during the test:

|                   |                              |
|-------------------|------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C |
| Relative humidity | Min. = 20 %<br>Max. = 75 %   |

## Remarks and comments

The tests have been performed by the technical personnel: Alfonso Gutiérrez, Miguel Ángel Torres and Javier Miguel Nadales.

Used instrumentation:

### Radiated Measurements:

|    |                                                                     | Last Calibration | Due Calibration |
|----|---------------------------------------------------------------------|------------------|-----------------|
| 1. | Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP     | N/A              | N/A             |
| 2. | Shielded Room ETS LINDGREN S101                                     | N/A              | N/A             |
| 3. | Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D       | 2020/08          | 2023/08         |
| 4. | Biconical/Log Antenna 30MHz - 6 GHz ETS LINDGREN 3142E              | 2020/10          | 2023/10         |
| 5. | RF Preamplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A        | 2021/12          | 2022/12         |
| 6. | Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40 | 2020/03          | 2022/03         |
| 7. | Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500        | N/A              | N/A             |
| 8. | UXM 5G RF Test Platform KEYSIGHT TECHNOLOGIES E7515B                | N/A              | N/A             |
| 9. | EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7                      | 2021/11          | 2023/11         |

## Testing verdicts

|                 |     |
|-----------------|-----|
| Not applicable: | N/A |
| Pass:           | P   |
| Fail:           | F   |
| Not measured:   | N/M |

## Summary

| FCC PART 22 / RSS-132 PARAGRAPH                                   |         |        |
|-------------------------------------------------------------------|---------|--------|
| Requirement – Test case                                           | Verdict | Remark |
| FCC 22.913 / RSS-132 5.4: RF output power                         | N/M     | (1)    |
| FCC 2.1047 / RSS-132 5.2: Modulation characteristics              | N/M     | (1)    |
| FCC 22.355 / RSS-132 5.3: Frequency stability                     | N/M     | (1)    |
| FCC 2.1049: Occupied Bandwidth                                    | N/M     | (1)    |
| FCC 22.917 / RSS-132 5.5: Spurious emissions at antenna terminals | N/M     | (1)    |
| FCC 22.917 / RSS-132 5.5: Radiated emissions                      | P       |        |
| <u>Supplementary information and remarks:</u>                     |         |        |
| (1) Test not requested                                            |         |        |

## Appendix A: Test results for FCC Part 22 / RSS-132

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## TEST CONDITIONS

The module with the highest antenna gain has been tested using the worst-case obtained for conducted output power for EN-Dual Connectivity. And the other module has been tested using an adjacent channel to the 5G with LTE band with a setting that would allow communication in the same band to both modules simultaneously.

This report covers the worst-case between EN-Dual Connectivity Bands DC\_2A\_n5A and DC\_66A\_n5A.

(\*): Data provided by the Applicant.

### POWER SUPPLY (\*):

Vnominal: 12 Vdc  
Type of Power Supply: External DC (vehicle battery).

### TEST FREQUENCIES (\*):

E-UTRA New Radio Dual Connectivity & LTE MIMO 2x2:

EN-Dual Connectivity Band DC\_2A\_n5A + LTE Band 5:

Table 4.3.1.1.1.5-1: Test frequencies for NR operating band n5 and SCS 15 kHz

| CBW<br>[MHz]                                                                                                                                                                                                                                                                                                                                                | carrier<br>Bandw<br>idth<br>[PRBs] | Range    |      | Carrier<br>centre<br>[MHz] | Carrier<br>centre<br>[ARFCN] | point A<br>[MHz] | absolute<br>Frequen<br>cyPoint<br>A<br>[ARFCN] | offsetTo<br>Carrier<br>[Carrier<br>PRBs] | SS<br>block<br>SCS<br>[kHz] | GSCN | absolute<br>Frequen<br>cySSB<br>[ARFCN] | $\Delta f_{SSB}$ | Offset<br>Carrier<br>CORE<br>SET#0<br>[RBs]<br>Note 2 | CORE<br>SET#0<br>Index<br>(Offset<br>[RBs])<br>Note 1 | offsetTo<br>PointA<br>(SIB1)<br>[PRBs]<br>Note 1 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------|------|----------------------------|------------------------------|------------------|------------------------------------------------|------------------------------------------|-----------------------------|------|-----------------------------------------|------------------|-------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------|
| 5                                                                                                                                                                                                                                                                                                                                                           | 25                                 | Downlink | Low  | 871.5                      | 174300                       | 869.25           | 173850                                         | 0                                        | 15                          | 2178 | 174270                                  | 8                | 1                                                     | 0 (0)                                                 | 1                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 881.5                      | 176300                       | 860.89           | 172178                                         | 102                                      |                             | 2203 | 176210                                  | 0                | 0                                                     | 0 (0)                                                 | 102                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 891.5                      | 178300                       | 798.53           | 159706                                         | 504                                      |                             | 2228 | 178330                                  | 4                | 1                                                     | 1 (2)                                                 | 507                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    | Uplink   | Low  | 826.5                      | 165300                       | 824.25           | 164850                                         | 0                                        | -                           | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 836.5                      | 167300                       | 743.53           | 148706                                         | 504                                      |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 846.5                      | 169300                       | 843.17           | 168634                                         | 6                                        |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
| 10                                                                                                                                                                                                                                                                                                                                                          | 52                                 | Downlink | Low  | 874                        | 174800                       | 869.32           | 173864                                         | 0                                        | 15                          | 2179 | 174290                                  | 10               | 1                                                     | 0 (0)                                                 | 1                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 881.5                      | 176300                       | 858.46           | 171692                                         | 102                                      |                             | 2197 | 175730                                  | 2                | 0                                                     | 0 (0)                                                 | 102                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 889                        | 177800                       | 793.6            | 158720                                         | 504                                      |                             | 2218 | 177410                                  | 2                | 1                                                     | 2 (4)                                                 | 509                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    | Uplink   | Low  | 829                        | 165800                       | 824.32           | 164864                                         | 0                                        | -                           | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 836.5                      | 167300                       | 741.1            | 148220                                         | 504                                      |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 844                        | 168800                       | 838.24           | 167648                                         | 6                                        |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
| 15                                                                                                                                                                                                                                                                                                                                                          | 79                                 | Downlink | Low  | 876.5                      | 175300                       | 869.39           | 173878                                         | 0                                        | 15                          | 2177 | 174250                                  | 4                | 0                                                     | 0 (0)                                                 | 0                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 881.5                      | 176300                       | 856.03           | 171206                                         | 102                                      |                             | 2191 | 175250                                  | 4                | 0                                                     | 0 (0)                                                 | 102                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 886.5                      | 177300                       | 788.67           | 157734                                         | 504                                      |                             | 2205 | 176430                                  | 4                | 1                                                     | 2 (4)                                                 | 509                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    | Uplink   | Low  | 831.5                      | 166300                       | 824.39           | 164878                                         | 0                                        | -                           | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 836.5                      | 167300                       | 738.67           | 147734                                         | 504                                      |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 841.5                      | 168300                       | 833.31           | 166662                                         | 6                                        |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
| 20                                                                                                                                                                                                                                                                                                                                                          | 106                                | Downlink | Low  | 879                        | 175800                       | 869.46           | 173892                                         | 0                                        | 15                          | 2178 | 174270                                  | 6                | 0                                                     | 0 (0)                                                 | 0                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 881.5                      | 176300                       | 853.6            | 170720                                         | 102                                      |                             | 2185 | 174770                                  | 6                | 0                                                     | 0 (0)                                                 | 102                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 884                        | 176800                       | 783.74           | 156748                                         | 504                                      |                             | 2192 | 175450                                  | 6                | 1                                                     | 2 (4)                                                 | 509                                              |
|                                                                                                                                                                                                                                                                                                                                                             |                                    | Uplink   | Low  | 834                        | 166800                       | 824.46           | 164892                                         | 0                                        | -                           | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | Mid  | 836.5                      | 167300                       | 736.24           | 147248                                         | 504                                      |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
|                                                                                                                                                                                                                                                                                                                                                             |                                    |          | High | 839                        | 167800                       | 828.38           | 165676                                         | 6                                        |                             | -    | -                                       | -                | -                                                     | -                                                     | -                                                |
| Note 1: The CORESET#0 Index and the associated CORESET#0 Offset refers to Table 13-1 in TS 38.213 [22]. The value of CORESET#0 Index is signalled in controlResourceSetZero (pdcch-ConfigSIB1) in the MIB. The offsetToPointA IE is expressed in units of resource blocks assuming 15 kHz subcarrier spacing for FR1 and 60 kHz subcarrier spacing for FR2. |                                    |          |      |                            |                              |                  |                                                |                                          |                             |      |                                         |                  |                                                       |                                                       |                                                  |
| Note 2: The parameter Offset Carrier CORESET#0 specifies the offset from the lowest subcarrier of the carrier and the lowest subcarrier of CORESET#0. It corresponds to the parameter $\Delta f_{\text{OffsetCORESET-0-Carrier}}$ in Annex C expressed in number of common RBs.                                                                             |                                    |          |      |                            |                              |                  |                                                |                                          |                             |      |                                         |                  |                                                       |                                                       |                                                  |

| Module NAD2                                                             |          |             |        |           |          |             |        | Module NAD1                |          |             |        |
|-------------------------------------------------------------------------|----------|-------------|--------|-----------|----------|-------------|--------|----------------------------|----------|-------------|--------|
| DC_2A_n5A                                                               |          |             |        |           |          |             |        | LTE Band 5                 |          |             |        |
| Inter-band. Test frequencies for DC_2A_n5A.                             |          |             |        |           |          |             |        |                            |          |             |        |
| Inter-band DC with a LTE Carrier in Band 2 and a 5G Carrier in Band n5. |          |             |        |           |          |             |        |                            |          |             |        |
| Channel                                                                 | 2A       |             |        | n5A       |          |             |        | Channel                    | BW (MHz) | Freq. (MHz) | EARFCN |
|                                                                         | BW (MHz) | Freq. (MHz) | EARFCN | SCS (kHz) | BW (MHz) | Freq. (MHz) | EARFCN |                            |          |             |        |
| Low                                                                     | 20       | 1860        | 18700  | 15        | 20       | 834         | 166800 | Adjacent channel to Low    | 5        | 846.5       | 20625  |
| Middle                                                                  | 20       | 1880        | 18900  | 15        | 20       | 836.5       | 167300 | Adjacent channel to Middle | 1.4      | 847.3       | 20633  |
| High                                                                    | 20       | 1900        | 19100  | 15        | 20       | 839         | 167800 | Adjacent channel to High   | 5        | 826.5       | 26815  |

## Radiated Emissions

### SPECIFICATION:

FCC §22.917 and RSS-132 Issue 3 Clause 5.5:

The power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

### METHOD:

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the High frequency generated within the equipment.

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum field strength (dBμV/m) is measured and recorded.

The maximum field strength (dBμV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

$EIRP (dBm) = E (dBμV/m) + 20 \log(D) - 104.8$ ; where D is the measurement distance (in the far field region) in m. D = 3 m

### Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in Watts.

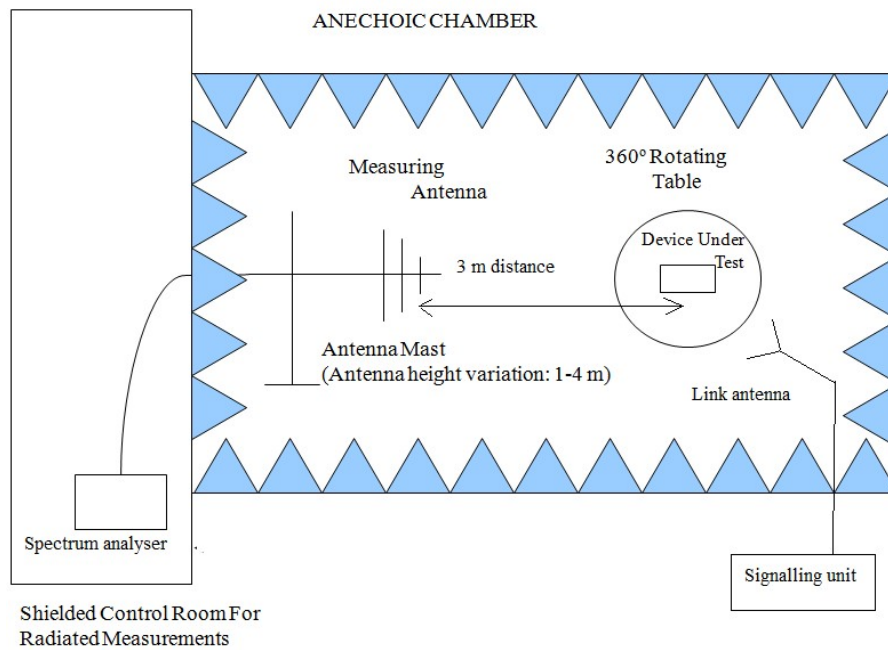
At  $P_o$  transmitting power. the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative  $P_o$  becomes:

$$P_o (dBm) - [43 + 10 \log (P_o \text{ in mWatts}) - 30] = -13 \text{ dBm}$$

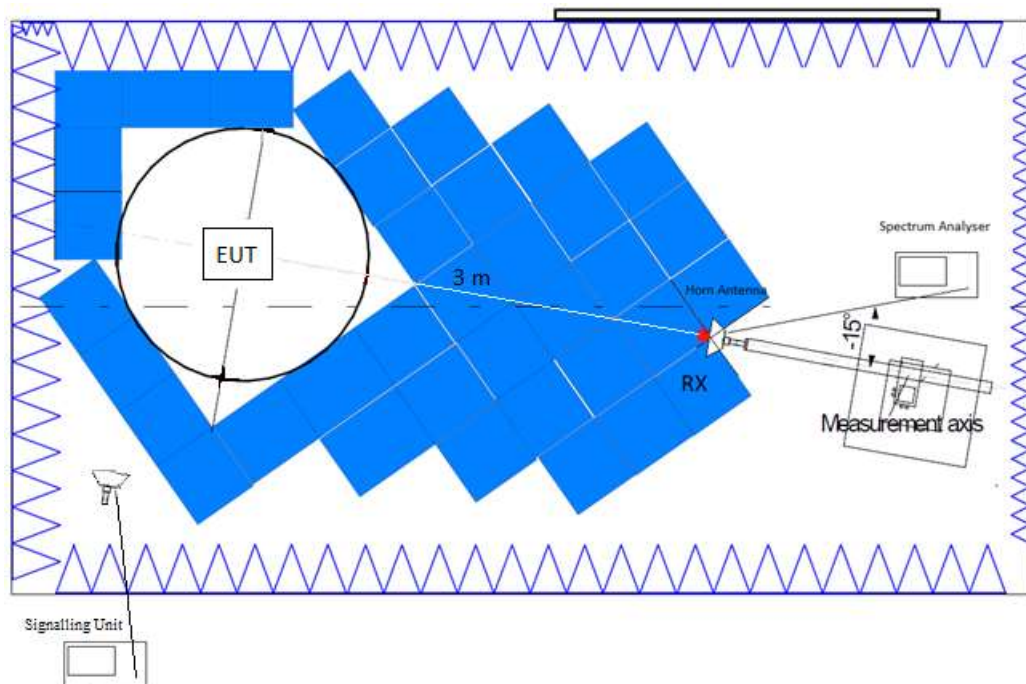
A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

## TEST SETUP:

Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz up to 8.5 GHz:



## RESULTS:

### • DC\_2A\_n5A + LTE Band 5:

A preliminary scan determined the worst-case:

- 1) DC\_2A\_n5A (Module NAD2):
  - 2A: QPSK, BW=20 MHz, RB=1, Offset=0.
  - n5A: Pi/2 BPSK, BW=20 MHz, SCS=15 kHz, RB=1, Offset=0.
- 2) LTE Band 5 (Module NAD1):
  - 5: QPSK, BW=5 MHz (for Low and High Channels), BW=1.4 MHz (for Middle Channel), RB=1, Offset=0.

The following results are the ones of the worst-case.

### - LOW CHANNEL:

#### Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

#### Frequency range 1 - 8.5 GHz:

No spurious frequencies at less than 20 dB below the limit.

### - MIDDLE CHANNEL:

#### Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

#### Frequency range 1 - 8.5 GHz:

Spurious frequencies at less than 20 dB below the limit:

| Spurious frequency (MHz) | E.I.R.P (dBm) | Polarization | Detector |
|--------------------------|---------------|--------------|----------|
| 5.64211                  | -31.13        | H            | Peak     |

### - HIGH CHANNEL:

#### Frequency range 30 MHz - 1 GHz:

No spurious frequencies at less than 20 dB below the limit.

#### Frequency range 1 - 8.5 GHz:

Spurious frequencies at less than 20 dB below the limit:

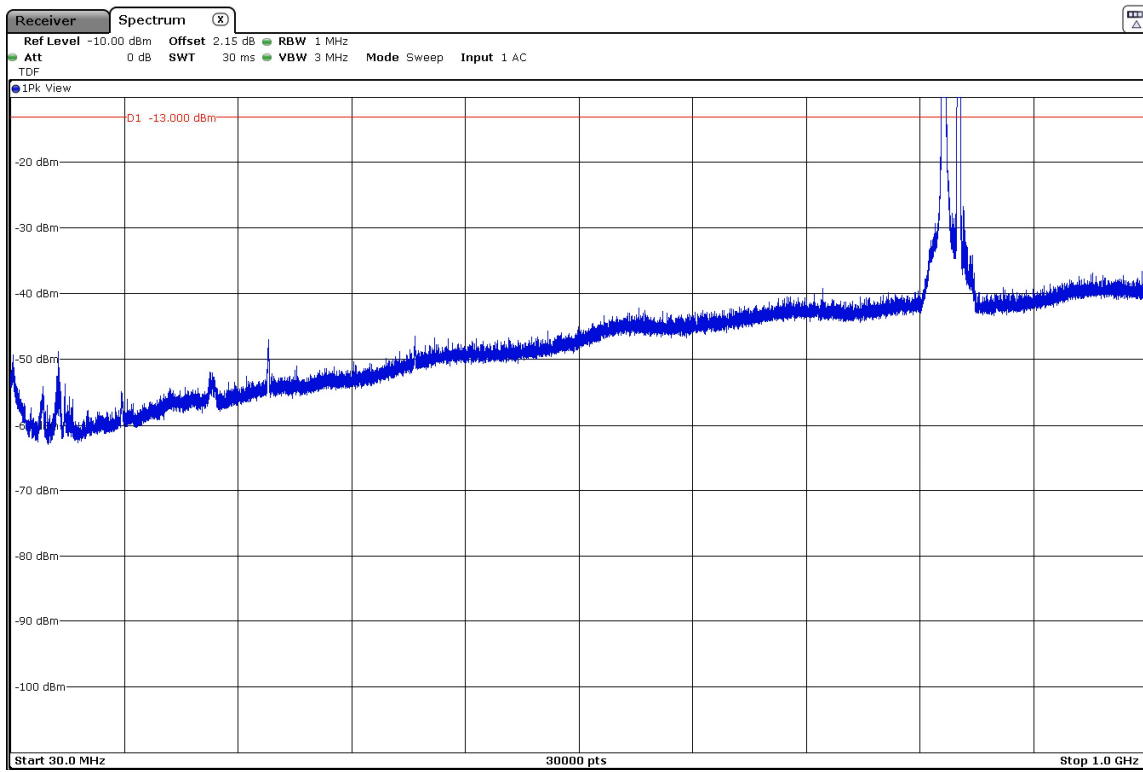
| Spurious frequency (MHz) | E.I.R.P (dBm) | Polarization | Detector |
|--------------------------|---------------|--------------|----------|
| 2.478033                 | -31.34        | V            | Peak     |
| 3.80144                  | -24.77        | H            | Peak     |
| 5.7169                   | -17.83        | H            | Peak     |

Measurement Uncertainty (dB):  $\leq \pm 4.99$  for  $f \geq 30$  MHz up to 1 GHz  
 $\leq \pm 4.98$  for  $f \geq 1$  GHz up to 8.5 GHz

Verdict: PASS

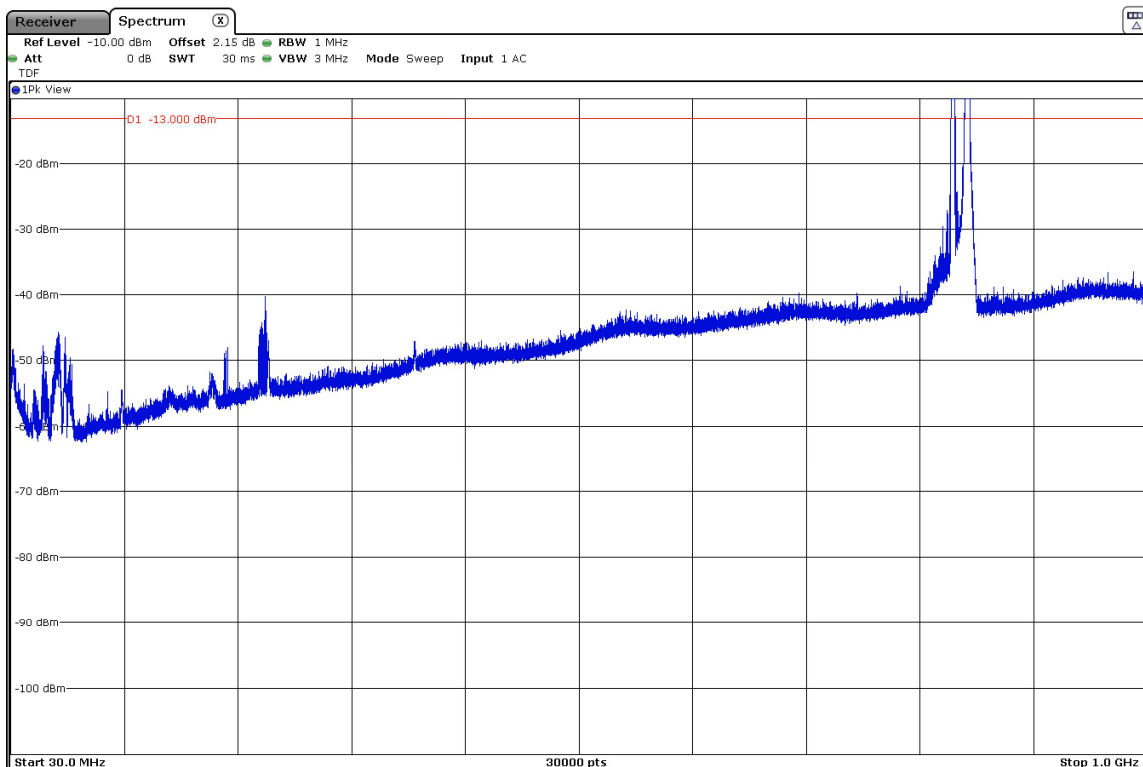
## FREQUENCY RANGE 30 MHz - 1 GHz (worst-case):

- Low Channel:



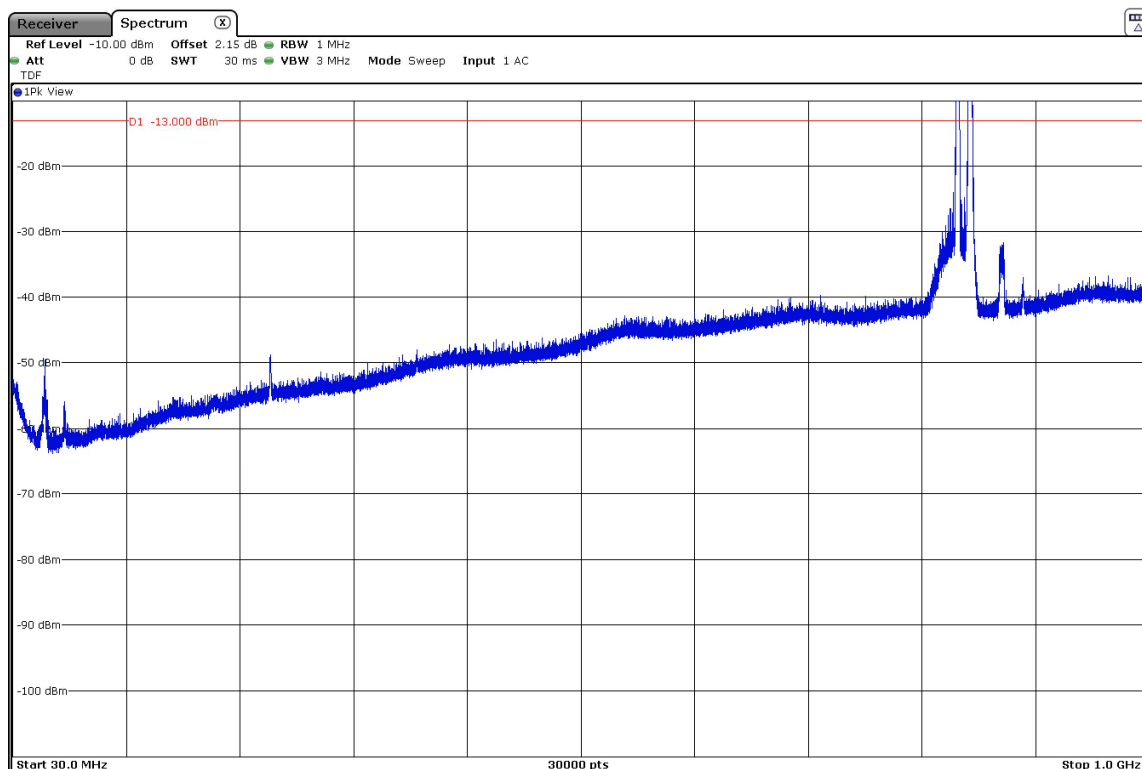
The peaks above the limit are the carrier frequencies.

- Middle Channel:



The peaks above the limit are the carrier frequencies.

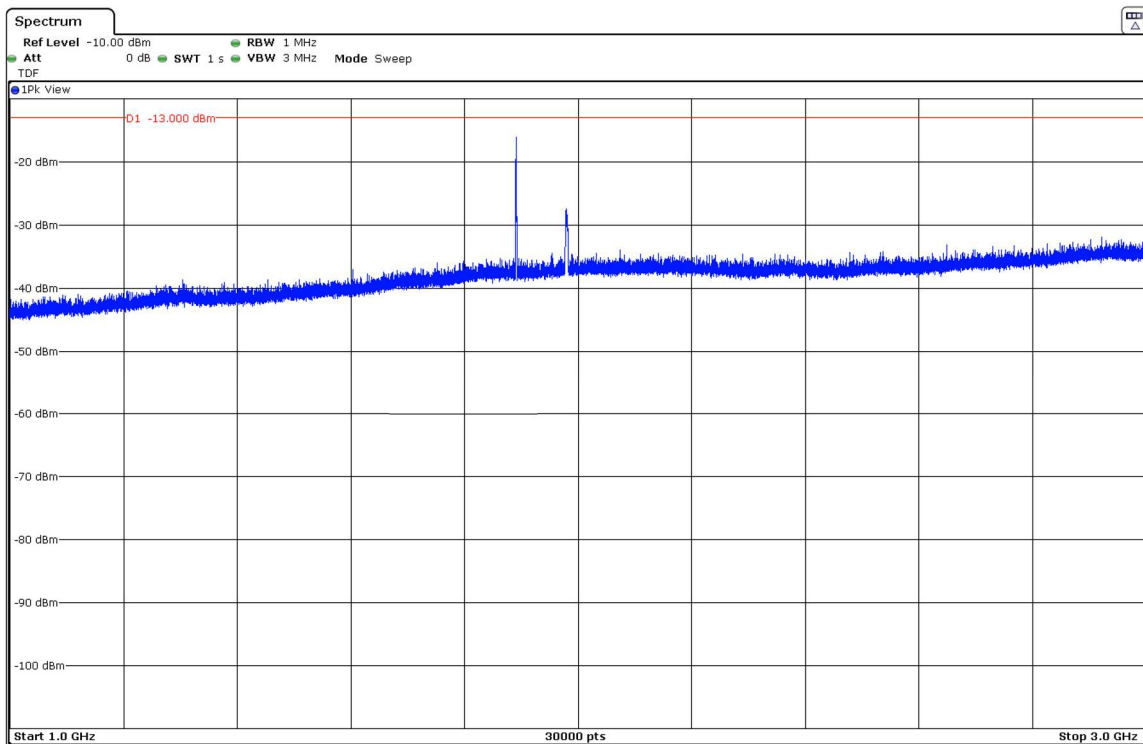
- High Channel:



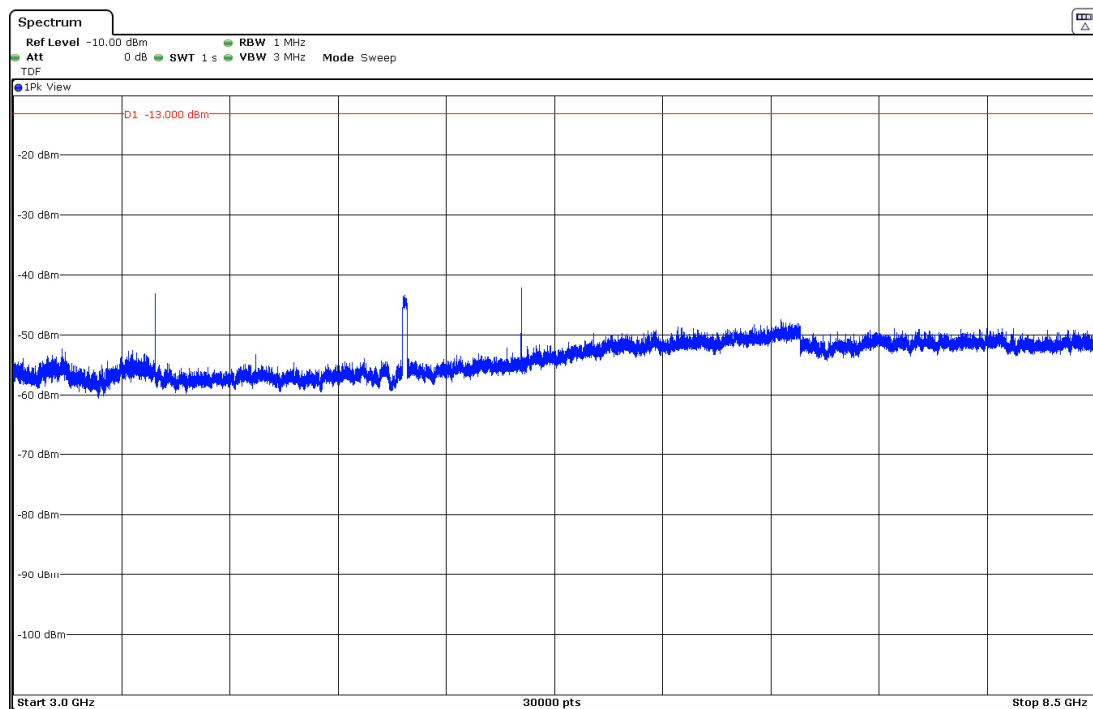
The peaks above the limit are the carrier frequencies. The peaks at 871.5MHz and 884MHz correspond to the downlink signals.

## FREQUENCY RANGE 1 - 8.5 GHz (worst-case):

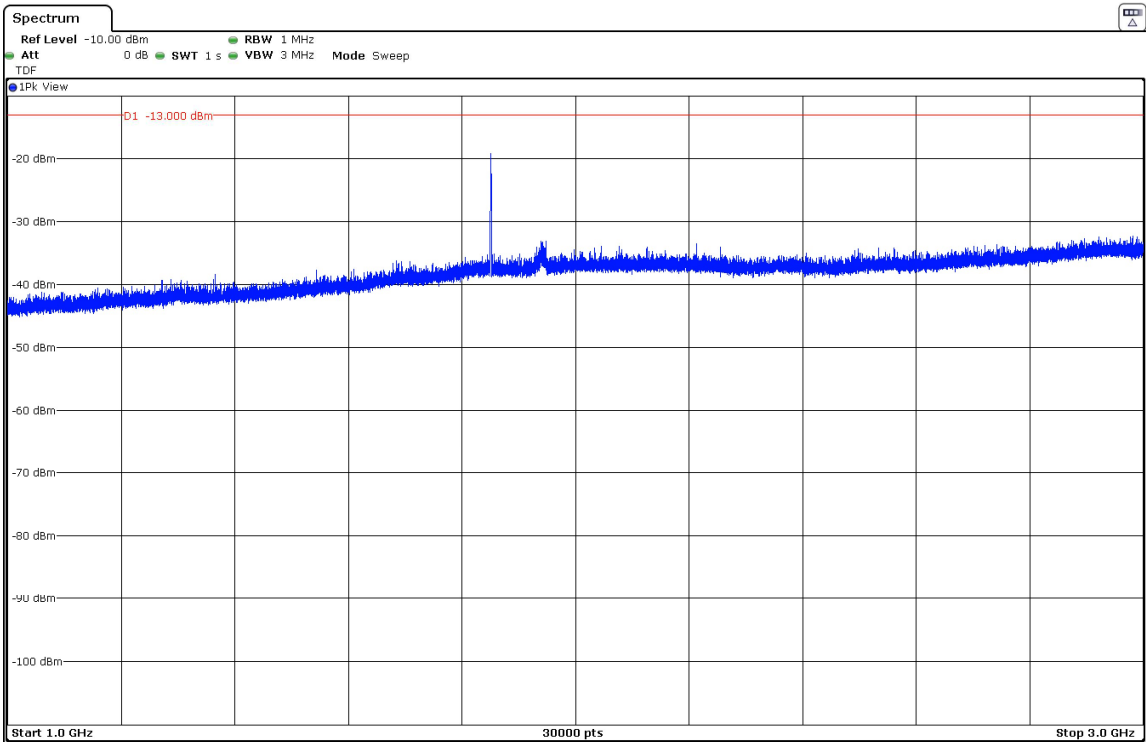
- Low Channel:



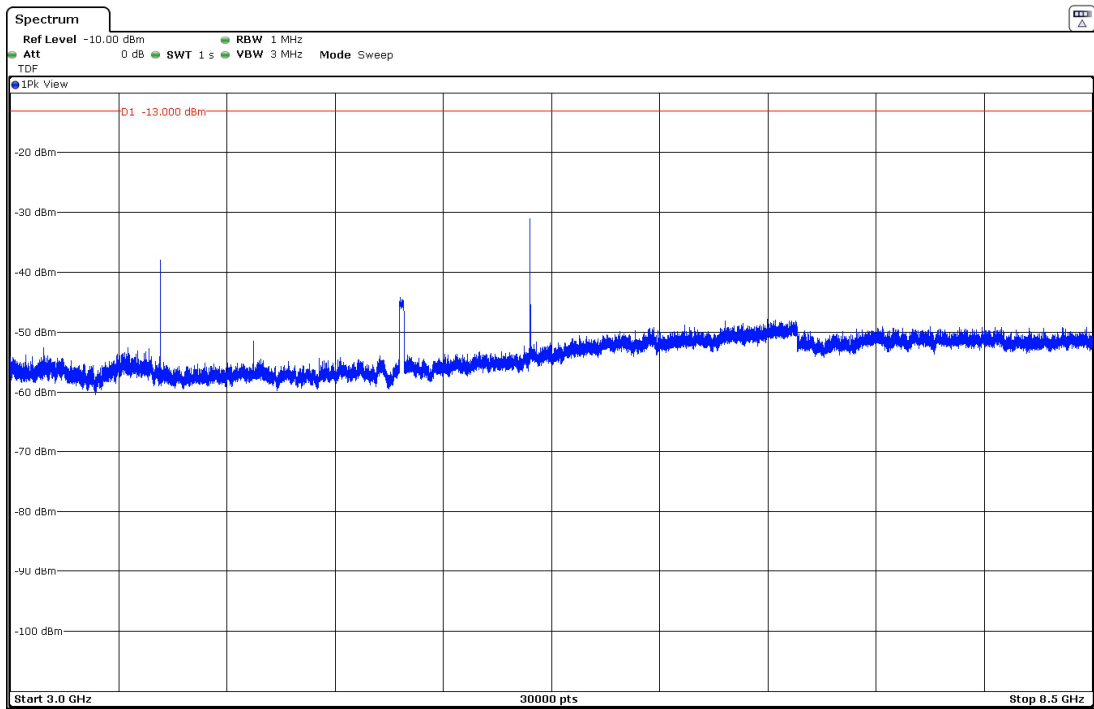
The peaks near the limit are the carrier frequencies and the downlink signal (2A).



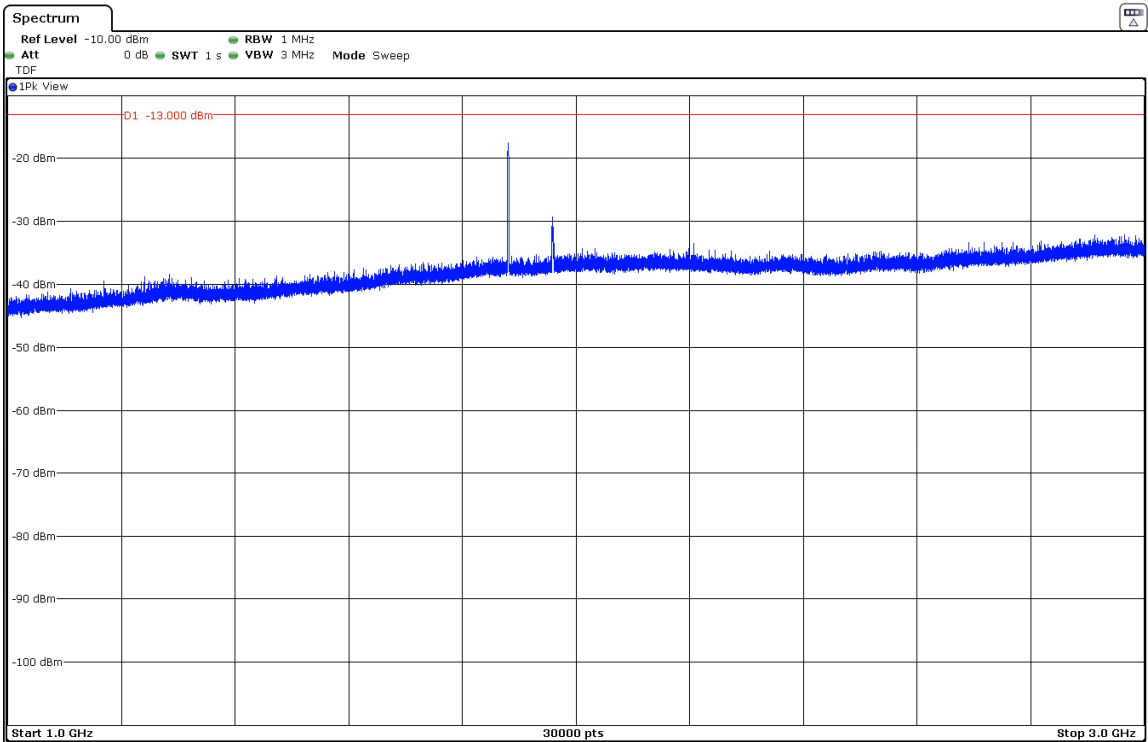
- Middle Channel:



The peak near the limit is the carrier frequency (2A).



- High Channel:



The peaks near the limit are the carrier frequencies and the downlink signal (2A).

