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# RADIO TEST REPORT – 446658-1TRFWL

Type of assessment:

Class II Permissive Change

Applicant:

Blinq Wireless, Inc.

Product:

Base station

Model:

FW6-B41-00-WW

FCC ID:

ROR0009

Specifications:

FCC 47 CFR Part 27

Date of issue: August 17, 2021

Fahar Abdul Sukkoor, EMC/RF Specialist
Tested by

Signature

Mark Libbrecht, EMC/RF Specialist
Reviewed by

Signature

| | | | | |
|---|---|---|---|---|
| Company name | Nemko Canada Inc. | | | |
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| Test site registration | **Organization** | **Recognition numbers and location** | | |
| | FCC/ISED | FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (Montreal); **CA0101 (Cambridge)** | | |
| Website | www.nemko.com | | | |

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

# Table of contents

# **Section 1.** Report summary

## 1.1 Applicant and manufacturer

| | |
|---|---|
| Company name | Blinq Wireless, Inc. |
| Address | 140 Renfrew Drive Suite 200, Markham, ON, Canada, L3R 6B3 |

## 1.2 Test specifications

| | |
|---|---|
| FCC 47 CFR Part 27 | Miscellaneous Wireless Communications Services |

## 1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

## 1.4 Exclusions

This report contains results for new additional bandwidth (5 and 15 MHz) channels included into specifications of the unit. For original report, please refer to 408608-1TRFWL.

## 1.5 Test report revision history

| Revision # | Details of changes made to test report |
|---|---|
| TRF | Original report issued |

# **Section 2.** Summary of test results

## 2.1 FCC Part 27 test results

| Part | Test description | Verdict |
|---|---|---|
| §27.50(h) | Peak output power | Pass |
| §27.53(m) | Emission limits | Pass |
| §27.54 | Frequency stability[1] | Pass |
| §2.1049 | Emission bandwidth | Pass |

Notes:1) For frequency stability results, please refer to original report 408608-1TRFWL

# **Section 3.** Equipment under test (EUT) details

## 3.1 Sample information

| | |
|---|---|
| Receipt date | July 28, 2021 |
| Nemko sample ID number | 1 |

## 3.2 EUT information

| | |
|---|---|
| Product name | Base station |
| Model | FW6-B41-00-WW |
| Serial number | 6010102-20370009 |
| Software version | BLiNQ_FW600_3.0.1_46917 |

## 3.3 Technical information

| | |
|---|---|
| Frequency band | 2496-2690 MHz |
| Frequency Min (MHz) | 2499 (5MHz) 2504 (15 MHz) |
| Frequency Max (MHz) | 2687 (5MHz) 2682 (15 MHz) |
| RF power Max (W), EIRP | 1011.6 (5 MHz) 995.4 (15 MHz) |
| Field strength, Units @ distance | N/A |
| Measured BW (MHz) (26 dB) | 4.83 (5 MHz) 14.48 (15 MHz) |
| Type of modulation | OFDM using QPSK and 16-64 QAM modulation |
| Emission classification (F1D, G1D, D1D) | W7D |
| Power requirements | 48 $V_{DC}$ via 120-240 Vac power adaptor |
| MIMO type | 2 × 2 with completely uncorrelated type of signal |
| Antenna information | 1)21.9dBi / 10.5deg Azimuth BW ( MBA6F-V2A from CCI Products)<br>2)21.5dBi / 12.8deg Azimuth BW (MBA3F-E3A from CCI Products)<br>3) Common Sectorial Antennae ( MTI-344075-ND, MT-344036/NV from MTI Wireless Edge Limited)<br>• Antenna gain 15dBi/16dBi/17dBi<br>• Azimuth BW: 60Deg/65Deg/90Deg<br>All antenna referred above are sufficiently uncorrelated.<br>The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. |

## 3.4 Product description and theory of operation

The BLiNQ FW-600 system is a tri-sector and tri-carrier Long-Term Evolution (LTE) Evolved Node B (eNB) with the capability to operate in the following bands:41, 42, 43, 46 and 48. With a distinctive feature set and integration level, the FW-600 brings an ideal solution to an “install anywhere” micro-base transceiver station (micro-BTS) that fully serves private networks, fixed wireless access and mobility use cases

## 3.5 EUT exercise details

The EUT was controlled from laptop via Ethernet using Tera term. Link
Power settings table:

| BW | 5 (MHz) | 15 (MHz) |
|---|---|---|
| FW600- Sector 0 Power | 39dBm | 39dBm |
| FW600- Sector 1 Power | 39dBm | 39dBm |
| FW600- Sector 2 Power | 39dBm | 39dBm |

"Note: 1. With 5MHz bandwidth carrier, power setting is limited to 36dBm if the carrier is occupying 3MHz from low and high band edges 2496MHz and 2690MHz, respectively. With 15MHz bandwidth carrier power setting is limited to 38dBm if the carrier is occupying 8MHz from low and and band edges 2496MHz and 2690MHz respectively

## 3.6 EUT setup diagram

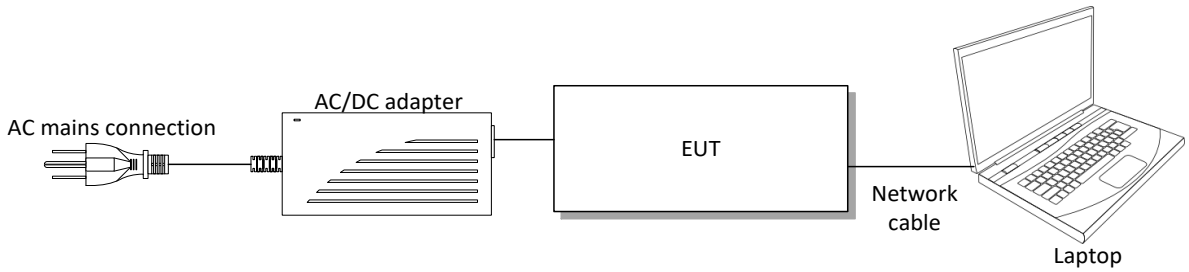



***Figure 3.6-1:*** *Setup diagram*

## 3.7 EUT support equipment

***Table 3.7-1:*** *EUT sub assemblies*

| Description | Brand name | Model/Part number | Serial number |
|---|---|---|---|
| Power adaptor | Mean Well | HLG-600H-48 | RB99055873 |
| laptop | Dell Latitude | E6440 | FA002914 |

# **Section 4.** Engineering considerations

## 4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

## 4.2 Technical judgment

Measurements results are provided for one sector. All three sectors of EUT have identical emission and power output characteristics as declared by manufacturer.

Most measurements are shown in QPSK modulation as it is considered worst case scenario. 64QAM modulation is also checked for power and emission spurious characteristics.

## 4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

# **Section 5.** Test conditions

## 5.1 Atmospheric conditions

| | |
|---|---|
| Temperature | 15–30 °C |
| Relative humidity | 20–75 % |
| Air pressure | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

## 5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

# **Section 6.** Measurement uncertainty

## 6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

| Test name | Measurement uncertainty, dB |
|---|---|
| All antenna port measurements | 0.55 |
| Conducted spurious emissions | 1.13 |
| Radiated spurious emissions | 3.78 |

# **Section 7.** Test equipment

## 7.1 Test equipment list

***Table 7.1-1:*** *Equipment list*

| Equipment | Manufacturer | Model no. | Asset no. | Cal cycle | Next cal. |
|---|---|---|---|---|---|
| 3 m EMI test chamber | TDK | SAC-3 | FA003012 | 1 year | Oct 10/21 |
| Flush mount turntable | SUNAR | FM2022 | FA003006 | — | NCR |
| Controller | SUNAR | SC110V | FA002976 | — | NCR |
| Antenna mast | SUNAR | TLT2 | FA003007 | — | NCR |
| Receiver/spectrum analyzer | Rohde & Schwarz | ESR26 | FA002969 | 1 year | Nov 12/21 |
| Spectrum analyzer | Rohde & Schwarz | FSW43 | FA002971 | 1 year | Nov 13/21 |
| Temperature chamber | Espec | EPX-4H | FA003033 | 1 year | VOU |
| Radiated Emissions cable set | Huber + Suhner Inc | — | FA003047 | — | NCR |
| Radiated Emissions cable set | Huber + Suhner Inc | — | FA003044 | — | NCR |
| Preamp (1–18 GHz) | ETS-Lindgren | 124334 | FA002956 | 1 year | April 05/22 |
| Bilog antenna (20–2000 MHz) | Sun AR | JB1 | FA003009 | 1 year | Sep 17/21 |
| Horn antenna (1–18 GHz) | Electro-Metrics | 3115 | FA000649 | 1 year | Sep 11/21 |
| Horn Antenna (18 -40 GHz) | ETS-Lindgren | 3116B | FA002948 | 1 year | Jan 22/22 |
| Pre-Amp (18-40 GHz) | Nemko | — | FA003323 | 1 year | NCR |

Note: NCR - no calibration required, VOU - verify on use

# **Section 8.** Testing data

## 8.1 FCC 27.50(h) Peak output power

### 8.1.1 Definitions and limits

(1) Main, booster and base stations.

(i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) 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: EIRP = 33 dBW + 10 log(X/Y) dBW + 10 log(360/beamwidth) 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.

(4) For main, booster and response stations utilizing digital emissions with non-uniform power spectral density (e.g. unfiltered QPSK), the power measured within any 100 kHz resolution bandwidth within the 6 MHz channel occupied by the non-uniform emission cannot exceed the power permitted within any 100 kHz resolution bandwidth within the 6 MHz channel if it were occupied by an emission with uniform power spectral density, i.e., if the maximum permissible power of a station utilizing a perfectly uniform power spectral density across a 6 MHz channel were 2000 watts EIRP, this would result in a maximum permissible power flux density for the station of 2000/60 = 33.3 watts EIRP per 100 kHz bandwidth. If a non-uniform emission were substituted at the station, station power would still be limited to a maximum of 33.3 watts EIRP within any 100 kHz segment of the 6 MHz channel, irrespective of the fact that this would result in a total 6 MHz channel power of less than 2000 watts EIRP.

(i) Peak transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

### 8.1.2 Test summary

| | |
|---|---|
| Test date | July 28, 2021 |
| Test engineer | Fahar A Sukkoor |
| Verdict | Pass |

### 8.1.3 Observations, settings and special notes

Power tables are shown for both QPSK and 64 QAM modulation.
Power is measured based on ANSI C 63 26 :2015 Clause 5.2.4.4 .1 measuring average power of a broadband signal with a spectrum/signal analyzer or EMI receiver (RMS power averaging across OBW).

Spectrum analyzer settings were:

| | |
|---|---|
| Resolution bandwidth | 500 – 1000 kHz |
| Video bandwidth | 1 –3 MHz |
| Detector mode | RMS |
| Trace mode | Power averaging over channel bandwidth |

### 8.1.4 Test data

**EIRP limit line calculations.**

For 21.9dBi / 10.5deg Azimuth BW ( MBA6F-V2A from CCI Products)

$EIRP_{5\ MHz} = 63 + 10 \times Log_{10}(5 / 5.5) + 10 \times Log_{10}(360 / 10.5) = 77.94$ dBm

$EIRP_{15\ MHz} = 63 + 10 \times Log_{10}(15 / 5.5) + 10 \times Log_{10}(360 / 10.5) = 82.71$ dBm

$EIRP_{5MHz} = 63 + 10 \times Log_{10}(5 / 6) + 10 \times Log_{10}(360 / 10.5) = 77.56$ dBm

$EIRP_{15\ MHz} = 63 + 10 \times Log_{10}(15/ 6) + 10 \times Log_{10}(360 / 10.5) = 82.33$ dBm

For 21.5dBi / 12.8deg Azimuth BW (MBA3F-E3A from CCI Products):

$EIRP_{5\ MHz} = 63 + 10 \times Log_{10}(5 / 5.5) + 10 \times Log_{10}(360 / 12.8) = 77.08$ dBm

$EIRP_{15\ MHz} = 63 + 10 \times Log_{10}(15/ 5.5) + 10 \times Log_{10}(360 / 12.8) = 81.85$ dBm

$EIRP_{5\ MHz} = 63 + 10 \times Log_{10}(5 / 6) + 10 \times Log_{10}(360 / 12.8) = 76.70$ dBm

$EIRP_{15\ MHz} = 63 + 10 \times Log_{10}(15 / 6) + 10 \times Log_{10}(360 / 12.8) = 81.47$ dBm

Since EUT is used as a base station, EIRP limits are applicable.

As per manufacturer declaration base station is utilizing digital emissions with uniform power spectral density, hence power spectral density requirement is not applicable as per 47 CFR, Part 27(h)(4).

As per manufacturer declaration, for all other antennae listed in section 3.3 shall be used with same maximum power settings as antenna MBA6F-V2A.

## 8.1.4 Test data, continued

***Table 8.1-1:*** *EIRP measurements results for 5 MHz channel bandwidth with 21.9dBi / 10.5deg MBA6F-V2A from CCI Products antenna QPSK modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2499 | 5(low) | 1 | 35.84 | 20.90 | 56.74 | 77.94 | 21.20 |
| | | 2 | 35.73 | 20.90 | 56.63 | 77.94 | 21.31 |
| 2593 | 5(mid) | 1 | 39.04 | 20.90 | 59.94 | 77.56 | 17.62 |
| | | 2 | 39.04 | 20.90 | 59.94 | 77.56 | 17.62 |
| 2687 | 5(high) | 1 | 36.03 | 20.90 | 56.93 | 77.94 | 21.01 |
| | | 2 | 36.16 | 20.90 | 57.06 | 77.94 | 20.88 |
| 2502 | 5(low) | 1 | 39.01 | 20.90 | 59.91 | 77.94 | 18.03 |
| | | 2 | 39.04 | 20.90 | 59.94 | 77.94 | 18.00 |
| 2684 | 5(high) | 1 | 39.04 | 20.90 | 59.94 | 77.94 | 18.00 |
| | | 2 | 39.13 | 20.90 | 60.03 | 77.94 | 17.91 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-2:*** *EIRP measurements results for 15 MHz channel bandwidth with 21.9dBi / 10.5deg MBA6F-V2A from CCI Products antenna QPSK modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2504 | 15(low) | 1 | 37.75 | 20.90 | 58.65 | 82.71 | 24.06 |
| | | 2 | 37.75 | 20.90 | 58.65 | 82.71 | 24.06 |
| 2593 | 15(mid) | 1 | 39.02 | 20.90 | 59.92 | 82.33 | 22.41 |
| | | 2 | 38.79 | 20.90 | 59.69 | 82.33 | 22.64 |
| 2682 | 15(high) | 1 | 38.27 | 20.90 | 59.17 | 82.71 | 23.54 |
| | | 2 | 38.34 | 20.90 | 59.24 | 82.71 | 23.47 |
| 2509 | 15(low) | 1 | 39.03 | 20.90 | 59.93 | 82.71 | 22.78 |
| | | 2 | 38.79 | 20.90 | 59.69 | 82.71 | 23.02 |
| 2677 | 15(high) | 1 | 39.07 | 20.90 | 59.97 | 82.71 | 22.74 |
| | | 2 | 38.96 | 20.90 | 59.86 | 82.71 | 22.85 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-3:*** *EIRP measurements results for 5 MHz channel bandwidth with 21.5dBi / 12.8deg MBA3F-E3A from CCI Products antenna QPSK modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2499 | 5(low) | 1 | 35.84 | 20.50 | 56.34 | 77.08 | 20.74 |
| | | 2 | 35.73 | 20.50 | 56.23 | 77.08 | 20.85 |
| 2593 | 5(mid) | 1 | 39.04 | 20.50 | 59.54 | 76.70 | 17.16 |
| | | 2 | 39.04 | 20.50 | 59.54 | 76.70 | 17.16 |
| 2687 | 5(high) | 1 | 36.03 | 20.50 | 56.53 | 77.08 | 20.55 |
| | | 2 | 36.16 | 20.50 | 56.66 | 77.08 | 20.42 |
| 2502 | 5(low) | 1 | 39.01 | 20.50 | 59.51 | 77.08 | 17.57 |
| | | 2 | 39.04 | 20.50 | 59.54 | 77.08 | 17.54 |
| 2684 | 5(high) | 1 | 39.04 | 20.50 | 59.54 | 77.08 | 17.54 |
| | | 2 | 39.13 | 20.50 | 59.63 | 77.08 | 17.45 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-4:*** *EIRP measurements results for 15 MHz channel bandwidth with 21.5dBi / 12.8deg MBA3F-E3A from CCI Products :antenna QPSK modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2504 | 15(low) | 1 | 37.75 | 20.50 | 58.25 | 81.85 | 23.60 |
| | | 2 | 37.75 | 20.50 | 58.25 | 81.85 | 23.60 |
| 2593 | 15(mid) | 1 | 39.02 | 20.50 | 59.52 | 81.47 | 21.95 |
| | | 2 | 38.79 | 20.50 | 59.29 | 81.47 | 22.18 |
| 2682 | 15(high) | 1 | 38.27 | 20.50 | 58.77 | 81.85 | 23.08 |
| | | 2 | 38.34 | 20.50 | 58.84 | 81.85 | 23.01 |
| 2509 | 15(low) | 1 | 39.03 | 20.50 | 59.53 | 81.85 | 22.32 |
| | | 2 | 38.79 | 20.50 | 59.29 | 81.85 | 22.56 |
| 2677 | 15(high) | 1 | 39.07 | 20.50 | 59.57 | 81.85 | 22.28 |
| | | 2 | 38.96 | 20.50 | 59.46 | 81.85 | 22.39 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

## 8.1.4 Test data, continued

***Table 8.1-5:*** *EIRP measurements results for 5 MHz channel bandwidth with 21.9dBi / 10.5deg MBA6F-V2A from CCI Products antenna 64 QAM modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2499 | 5(low) | 1 | 36.01 | 20.90 | 56.91 | 77.94 | 21.03 |
| | | 2 | 36.01 | 20.90 | 56.91 | 77.94 | 21.03 |
| 2593 | 5(mid) | 1 | 39.11 | 20.90 | 60.01 | 77.56 | 17.55 |
| | | 2 | 39.15 | 20.90 | 60.05 | 77.56 | 17.51 |
| 2687 | 5(high) | 1 | 35.98 | 20.90 | 56.88 | 77.94 | 21.06 |
| | | 2 | 36.11 | 20.90 | 57.01 | 77.94 | 20.93 |
| 2502 | 5(low) | 1 | 39.02 | 20.90 | 59.92 | 77.94 | 18.02 |
| | | 2 | 39.01 | 20.90 | 59.91 | 77.94 | 18.03 |
| 2684 | 5(high) | 1 | 39.01 | 20.90 | 59.91 | 77.94 | 18.03 |
| | | 2 | 39.04 | 20.90 | 59.94 | 77.94 | 18.00 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-6:*** *EIRP measurements results for 15 MHz channel bandwidth with 21.9dBi / 10.5deg MBA6F-V2A from CCI Products antenna 64QAM modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2504 | 15(low) | 1 | 37.63 | 20.90 | 58.53 | 82.71 | 24.18 |
| | | 2 | 37.68 | 20.90 | 58.58 | 82.71 | 24.13 |
| 2593 | 15(mid) | 1 | 39.08 | 20.90 | 59.98 | 82.33 | 22.35 |
| | | 2 | 39.06 | 20.90 | 59.96 | 82.33 | 22.37 |
| 2682 | 15(high) | 1 | 38.09 | 20.90 | 58.99 | 82.71 | 23.72 |
| | | 2 | 38.16 | 20.90 | 59.06 | 82.71 | 23.65 |
| 2509 | 15(low) | 1 | 39.06 | 20.90 | 59.96 | 82.71 | 22.75 |
| | | 2 | 38.98 | 20.90 | 59.88 | 82.71 | 22.83 |
| 2677 | 15(high) | 1 | 39.06 | 20.90 | 59.96 | 82.71 | 22.75 |
| | | 2 | 39.02 | 20.90 | 59.92 | 82.71 | 22.79 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-7:*** *EIRP measurements results for 5 MHz channel bandwidth with 21.5dBi / 12.8deg MBA3F-E3A from CCI Products antenna 64QAM modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2499 | 5(low) | 1 | 36.01 | 20.50 | 56.51 | 77.08 | 20.57 |
| | | 2 | 36.01 | 20.50 | 56.51 | 77.08 | 20.57 |
| 2593 | 5(mid) | 1 | 39.11 | 20.50 | 59.61 | 76.70 | 17.09 |
| | | 2 | 39.15 | 20.50 | 59.65 | 76.70 | 17.05 |
| 2687 | 5(high) | 1 | 35.98 | 20.50 | 56.48 | 77.08 | 20.60 |
| | | 2 | 36.11 | 20.50 | 56.61 | 77.08 | 20.47 |
| 2502 | 5(low) | 1 | 39.02 | 20.50 | 59.52 | 77.08 | 17.56 |
| | | 2 | 39.01 | 20.50 | 59.51 | 77.08 | 17.57 |
| 2684 | 5(high) | 1 | 39.01 | 20.50 | 59.51 | 77.08 | 17.57 |
| | | 2 | 39.04 | 20.50 | 59.54 | 77.08 | 17.54 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

***Table 8.1-8:*** *EIRP measurements results for 15 MHz channel bandwidth with 21.5dBi / 12.8deg MBA3F-E3A from CCI Products :antenna 64QAM modulation*

| Frequency, MHz | Bandwidth, MHz | Ch 1/2 | Output power, dBm | Antenna gain, dBi | EIRP, dBm | Limit, , dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 2504 | 15(low) | 1 | 37.63 | 20.50 | 58.13 | 81.85 | 23.72 |
| | | 2 | 37.68 | 20.50 | 58.18 | 81.85 | 23.67 |
| 2593 | 15(mid) | 1 | 39.08 | 20.50 | 59.58 | 81.47 | 21.89 |
| | | 2 | 39.06 | 20.50 | 59.56 | 81.47 | 21.91 |
| 2682 | 15(high) | 1 | 38.09 | 20.50 | 58.59 | 81.85 | 23.26 |
| | | 2 | 38.16 | 20.50 | 58.66 | 81.85 | 23.19 |
| 2509 | 15(low) | 1 | 39.06 | 20.50 | 59.56 | 81.85 | 22.29 |
| | | 2 | 38.98 | 20.50 | 59.48 | 81.85 | 22.37 |
| 2677 | 15(high) | 1 | 39.06 | 20.50 | 59.56 | 81.85 | 22.29 |
| | | 2 | 39.02 | 20.50 | 59.52 | 81.85 | 22.33 |

Note: 1 dB cable loss to EIRP is added to antenna gain.

## 8.1.4 Test data, continued

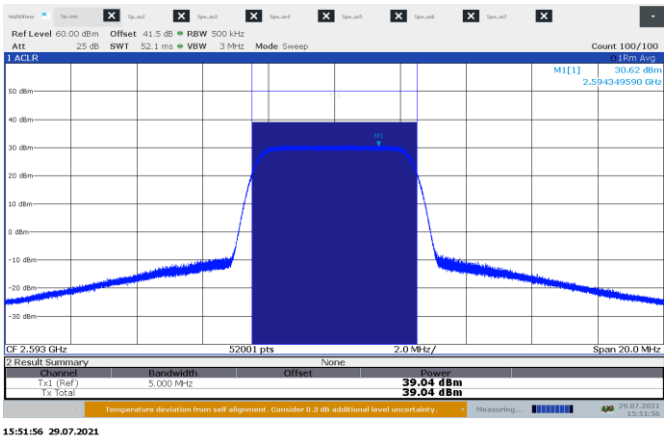



***Figure 8.1-1:*** *Output power for 5 MHz channel BW, sample plot*

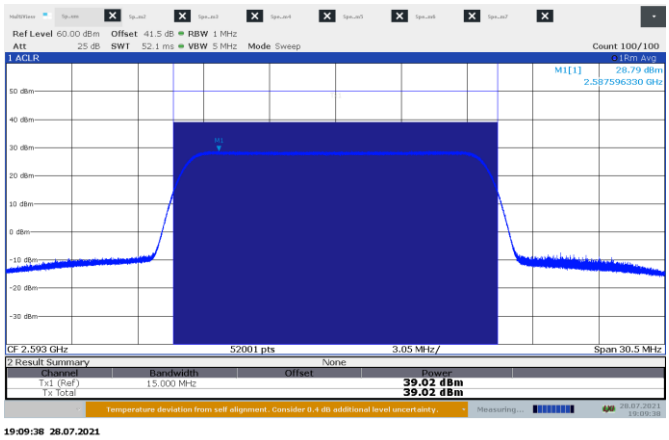



***Figure 8.1-2:*** *Output power for 15 MHz channel BW, sample plot*

## 8.2 FCC 27.53(m) Emission limits

### 8.2.1 Definitions and limits

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. Provided that a documented interference complaint cannot be mutually resolved between the parties prior to the applicable deadline, then the following additional attenuation requirements shall apply:

(i) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located 1.5 km or more away, within 24 hours of the receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block and shall immediately notify the complaining licensee upon implementation of the additional attenuation. No later than 60 days after the implementation of such additional attenuation, the licensee of the complaining base station must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(ii) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located less than 1.5 km away, within 24 hours of receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least 67 + 10 log (P)−20 log (Dkm/1.5) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the complaining licensee, or if both base stations are co-located, limit its undesired signal level at the pre-existing base station receiver(s) to no more than −107 dBm measured in a 5.5 megahertz bandwidth and shall immediately notify the complaining licensee upon such reduction in the undesired signal level. No later than 60 days after such reduction in the undesired signal level, the complaining licensee must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(iii) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located 1.5 km or more away, within 60 days of receipt of a documented interference complaint the licensee of each base station must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the other licensee.

(iv) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located less than 1.5 km away, within 60 days of receipt of a documented interference complaint: (a) The licensee of the new or modified base station must attenuate its OOBE by at least 67 + 10 log (P)−20 log (Dkm/1.5) measured 3 megahertz above or below, from the channel edge of its frequency block of the other licensee, or if the base stations are co-located, limit its undesired signal level at the other base station receiver(s) to no more than −107 dBm measured in a 5.5-megahertz bandwidth; and (b) the licensee causing the interference must attenuate its emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(v) For all fixed digital user stations, the attenuation factor shall be not less than 43 + 10 log (P) dB at the channel edge.

(3) Prior to transition and thereafter solely within the MBS, and notwithstanding paragraph (l)(2) of this section, the maximum out-of-band power of a digital transmitter operating on a single 6 MHz channel with an EIRP in excess of −9 dBW employing digital modulation for the primary purpose of transmitting video programming shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies.
(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

### 8.2.2 Test summary

| | |
|---|---|
| Test date | July 28, 2021 |
| Test engineer | Fahar A Sukkoor |
| Verdict | Pass |

### 8.2.3 Observations, settings and special notes

- The testing was performed conducted on each antenna port as well as radiated with both ports operating simultaneously in MIMO mode and terminated with 50 Ohm loads.
- Spurious emissions were tested from 30 MHz to the 10th harmonic. Only critical plots provided in test data below.
- For all conducted spurious emission plots, emissions are at least 10 dB below limit line.
- Spurious emission measurements based on ANSI C 63.26:2015 Clause 5.7.4 Spurious unwanted emission measurements.
- Band edge emisisons measurements are based on ANSI C 63.26:2015 Clause 5.7.3 Out of band unwanted emissions measurements.

Spectrum analyzer settings:

| | |
|---|---|
| Resolution bandwidth | 100 kHz (below 1 GHz) 1 MHz (conducted) |
| Video bandwidth | 3 × RBW |
| Detector and trace mode | RMS Power averaging (conducted), Peak Max-hold (radiated) |

Spectrum analyser settings for band edge emissions (within 1 MHz right outside 2496–2690 MHz band)

| | |
|---|---|
| Resolution bandwidth | 100 kHz for 5 MHz BW, 200 kHz for 15 MHz BW |
| Video bandwidth | 3 x RBW |
| Detector mode | RMS |
| Trace mode | Power Average over 1 MHz bandwidth |

### 8.2.4 Test data

***Table 8.2-1:*** *Band edge emission measurements at 2496 and 2690 MHz QPSK modulation results*

| Antenna port | Channel BW, MHz | Frequency of max emission, MHz | Emission level, dBm/MHz | Limit, dBm/MHz | Margin, dB |
|---|---|---|---|---|---|
| 1 | 5(low) | 2496 | -13.68 | -13.00 | 0.68 |
| 2 | 5(low) | 2496 | -13.20 | -13.00 | 0.20 |
| 1 | 5(high) | 2690 | -13.06 | -13.00 | 0.06 |
| 2 | 5(high) | 2690 | -13.26 | -13.00 | 0.26 |
| 1 | 5(low 2502 MHz)) | 2496 | -15.25 | -13.00 | 2.25 |
| 2 | 5(low 2502 MHz)) | 2496 | -14.32 | -13.00 | 1.32 |
| 1 | 5(high 2684 MHz) | 2690 | -15.19 | -13.00 | 2.19 |
| 2 | 5(high 2684 MHz) | 2690 | -14.31 | -13.00 | 1.31 |
| 1 | 15(low) | 2496 | -15.53 | -13.00 | 2.53 |
| 2 | 15 (low) | 2496 | -13.19 | -13.00 | 0.19 |
| 1 | 15 (high) | 2690 | -14.75 | -13.00 | 1.75 |
| 2 | 15 (high) | 2690 | -13.38 | -13.00 | 0.38 |
| 1 | 15 (low 2509 MHz)) | 2496 | -14.06 | -13.00 | 1.06 |
| 2 | 15 (low 2509 MHz)) | 2496 | -13.09 | -13.00 | 0.09 |
| 1 | 15 (high 2677 MHz) | 2690 | -15.94 | -13.00 | 2.94 |
| 2 | 15 (high 2677 MHz) | 2690 | -14.44 | -13.00 | 1.44 |

## 8.2.4 Test data, continued

***Table 8.2-2:*** *Band edge emission measurements at 2496 and 2690 MHz 64QAM modulation results*

| Antenna port | Channel BW, MHz | Frequency of max emission, MHz | Emission level, dBm/MHz | Limit, dBm/MHz | Margin, dB |
|---|---|---|---|---|---|
| 1 | 5(low) | 2496 | -13.68 | -13.00 | 0.68 |
| 2 | 5(low) | 2496 | -13.20 | -13.00 | 0.20 |
| 1 | 5(high) | 2690 | -13.06 | -13.00 | 0.06 |
| 2 | 5(high) | 2690 | -13.26 | -13.00 | 0.26 |
| 1 | 5(low 2502 MHz)) | 2496 | -15.25 | -13.00 | 2.25 |
| 2 | 5(low 2502 MHz)) | 2496 | -14.32 | -13.00 | 1.32 |
| 1 | 5(high 2684 MHz) | 2690 | -15.19 | -13.00 | 2.19 |
| 2 | 5(high 2684 MHz) | 2690 | -14.31 | -13.00 | 1.31 |
| 1 | 15(low) | 2496 | -15.53 | -13.00 | 2.53 |
| 2 | 15 (low) | 2496 | -13.19 | -13.00 | 0.19 |
| 1 | 15 (high) | 2690 | -14.75 | -13.00 | 1.75 |
| 2 | 15 (high) | 2690 | -13.38 | -13.00 | 0.38 |
| 1 | 15 (low 2509 MHz)) | 2496 | -14.06 | -13.00 | 1.06 |
| 2 | 15 (low 2509 MHz)) | 2496 | -13.09 | -13.00 | 0.09 |
| 1 | 15 (high 2677 MHz) | 2690 | -15.94 | -13.00 | 2.94 |
| 2 | 15 (high 2677 MHz) | 2690 | -14.44 | -13.00 | 1.44 |

## 8.2.4 Test data, continued

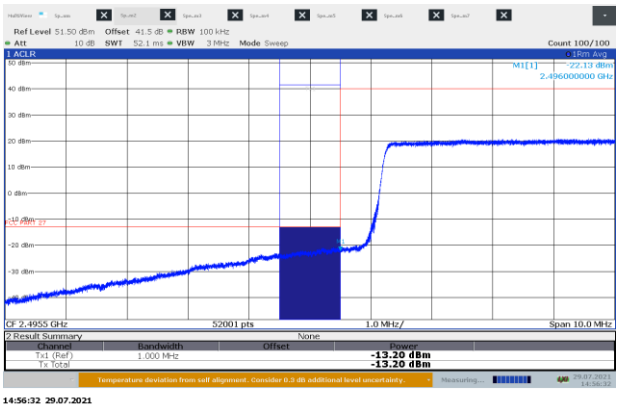



***Figure 8.2-1:*** *Band edge measurement 5 MHz low channel ,sample plot*

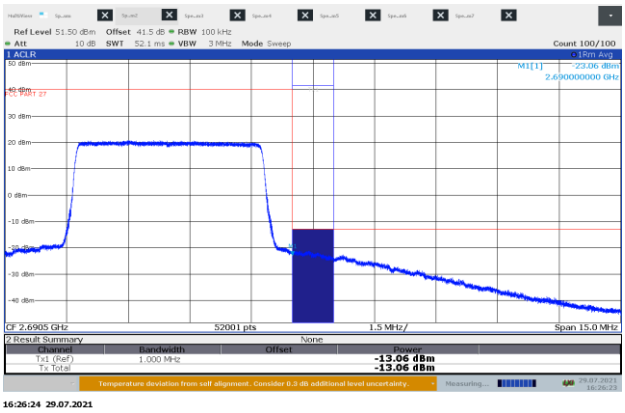



***Figure 8.2-2:*** *Band edge measurement 5 MHz high channel ,sample plot*

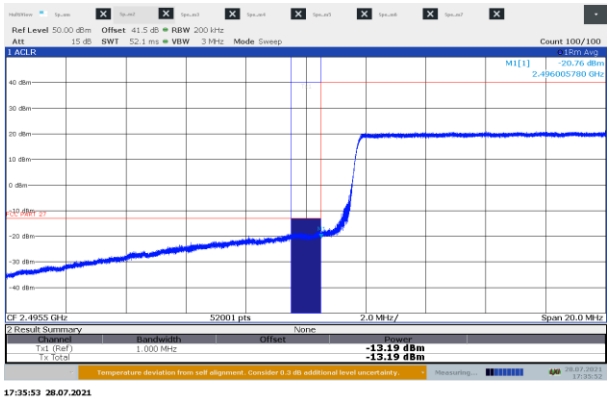



***Figure 8.2-3*** *Band edge measurement 15 MHz low channel ,sample plot*

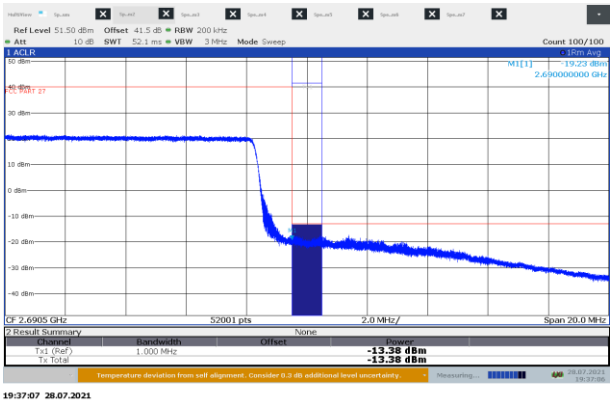



***Figure 8.2-4:*** *Band edge measurement 15 MHz high channel ,sample plot*

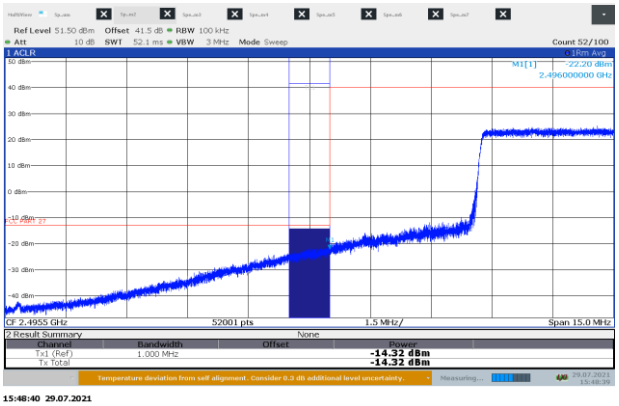



***Figure 8.2-5*** *Band edge measurement 5 MHz low channel 2502 MHz, sample plot*

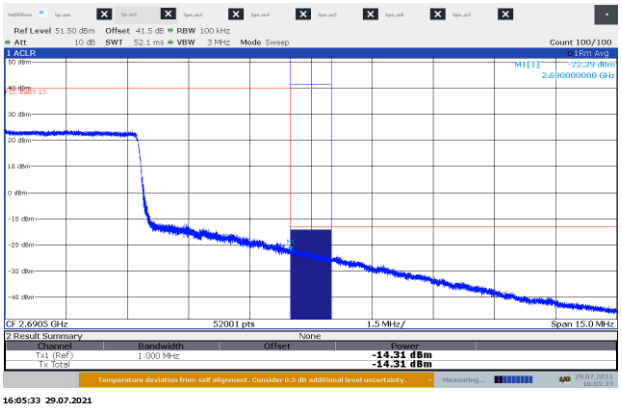



***Figure 8.2-6:*** *Band edge measurement 5 MHz high channel 2684 MHz, sample plot*

## 8.2.4 Test data, continued


***Figure 8.2-7:*** *Band edge measurement 15 MHz low channel 2509 MHz ,sample plot*

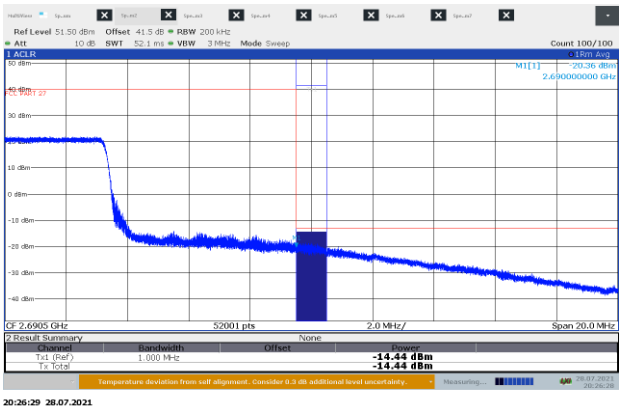



***Figure 8.2-8:*** *Band edge measurement 15 MHz high channel 2677 MHz ,sample plot*

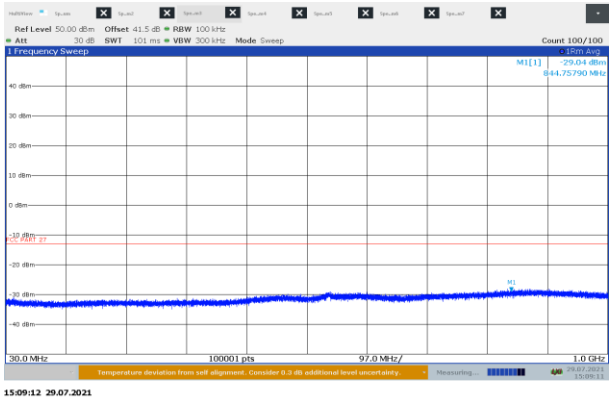



***Figure 8.2-9*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz low channel ,sample plot*

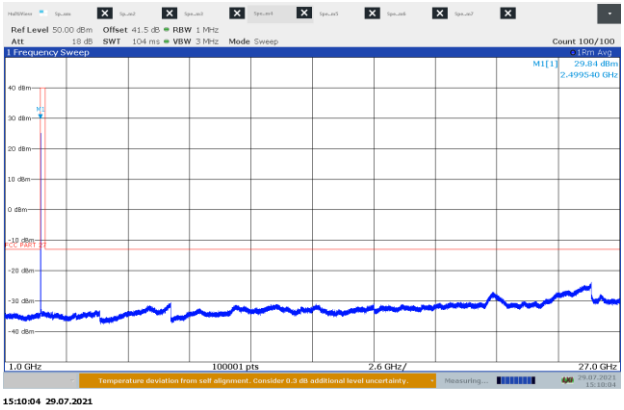



***Figure 8.2-10:*** *Conducted spurious emissions 1 – 27 GHz at 5 MHz low channel ,sample plot*

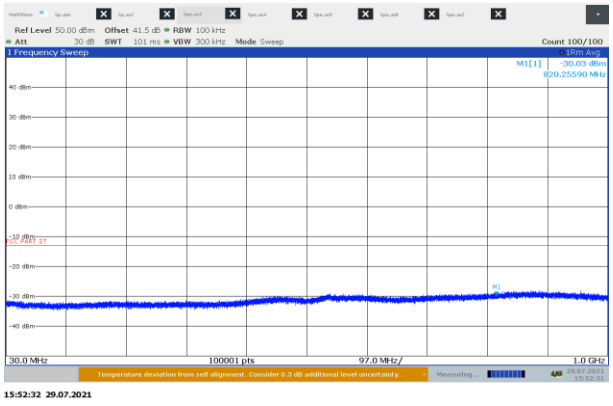



***Figure 8.2-11*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz mid channel ,sample plot*

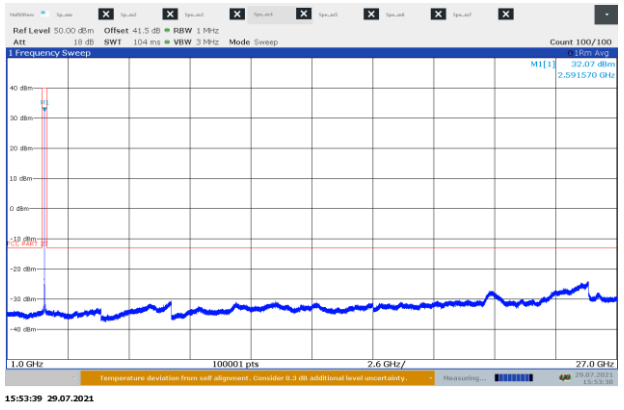



***Figure 8.2-12:*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz mid channel ,sample plot*

## 8.2.4 Test data, continued

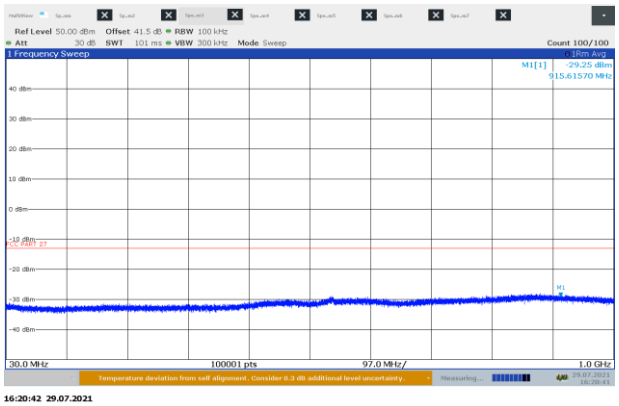



***Figure 8.2-13:*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz high channel ,sample plot*

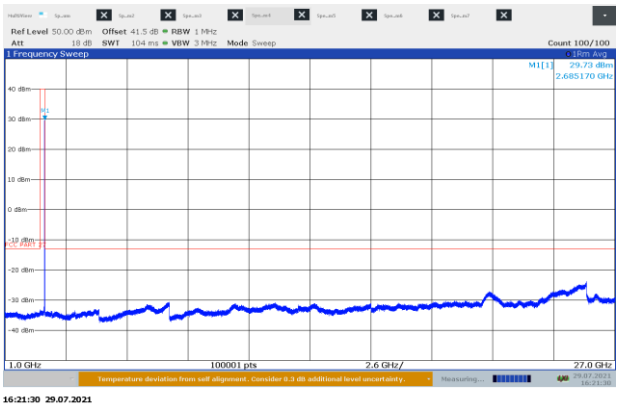



***Figure 8.2-14:*** *Conducted spurious emissions 1 – 27 GHz at 5 MHz high channel ,sample plot*

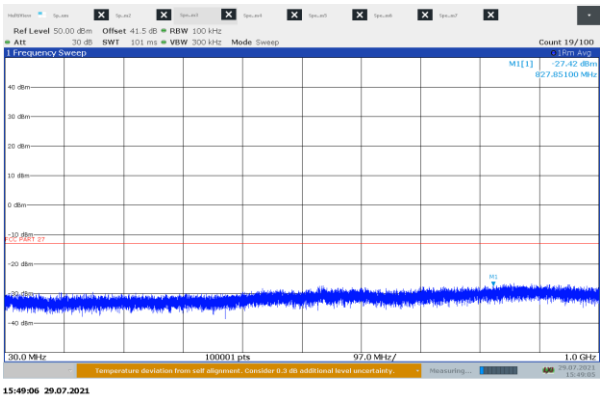



***Figure 8.2-15*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz low 2502 MHz channel ,sample plot*

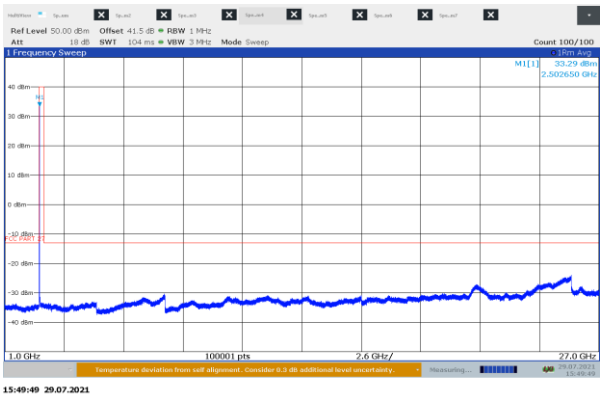



***Figure 8.2-16:*** *Conducted spurious emissions 1 – 27 GHz at 5 MHz low 2502 MHz channel ,sample plot*

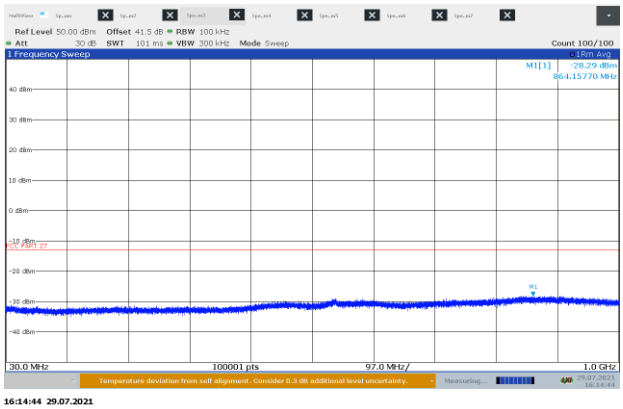



***Figure 8.2-17*** *Conducted spurious emissions 30 MHz -1 GHz at 5 MHz high 2684 MHz channel ,sample plot*

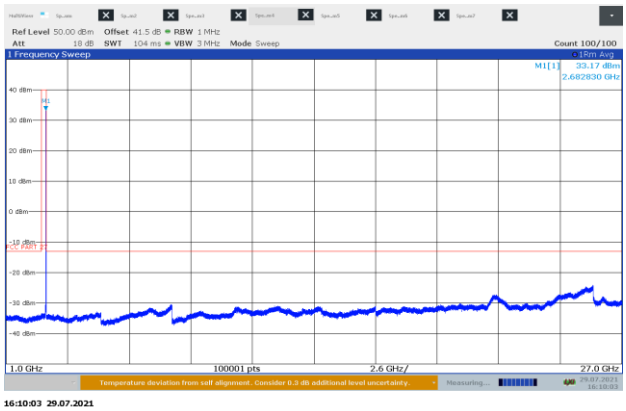



***Figure 8.2-18:*** *Conducted spurious emissions 1 – 27 GHz at 5 MHz high 2684 MHz channel ,sample plot*

## 8.2.4 Test data, continued

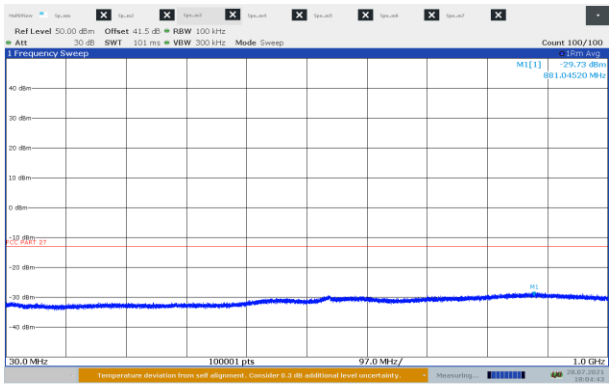



***Figure 8.2-19:*** *Conducted spurious emissions 30 MHz -1 GHz at 15 MHz low channel ,sample plot*

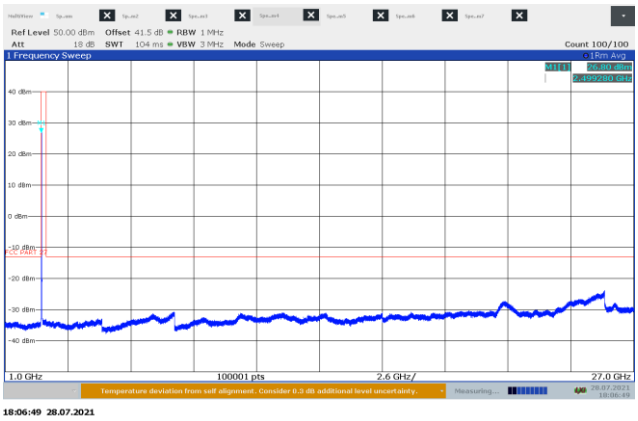



***Figure 8.2-20:*** *Conducted spurious emissions 1 – 27 GHz at 15 MHz low channel ,sample plot*

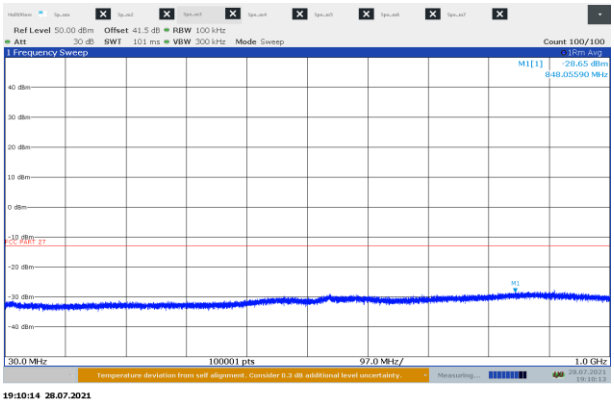



***Figure 8.2-21*** *Conducted spurious emissions 30 MHz -1 GHz at 15 MHz mid channel ,sample plot*

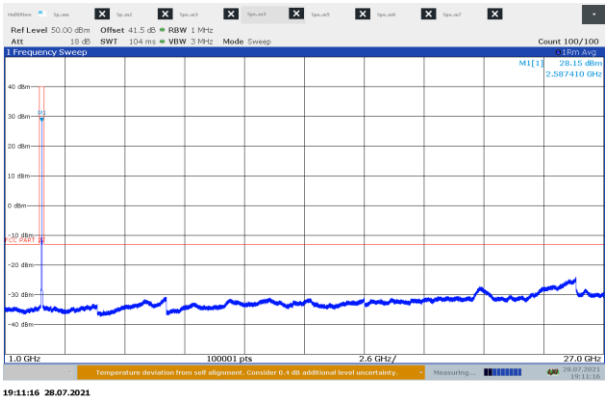



***Figure 8.2-22:*** *Conducted spurious emissions 1 – 27 GHz at 15 MHz mid channel ,sample plot*

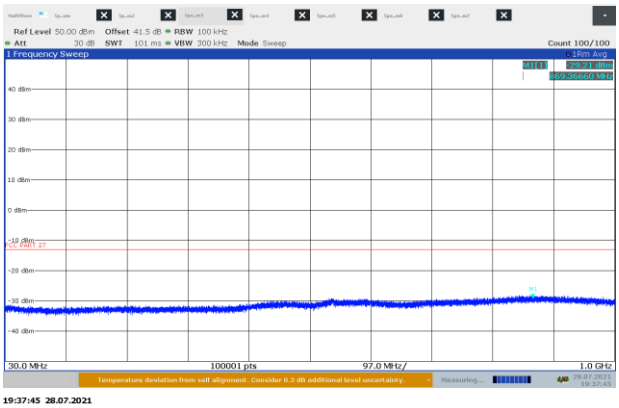



***Figure 8.2-23*** *Conducted spurious emissions 30 MHz -1 GHz at 15 MHz high channel ,sample plot*

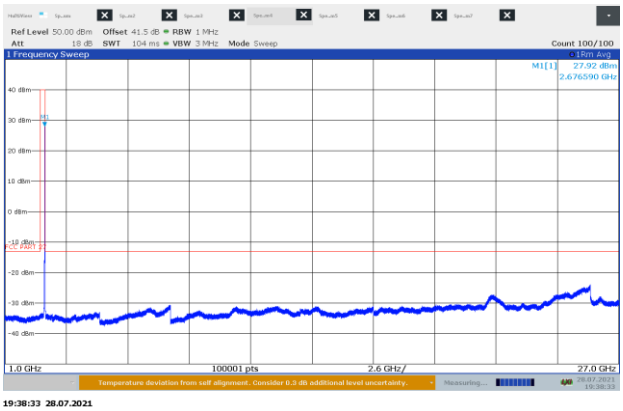



***Figure 8.2-24:*** *Conducted spurious emissions 1 -27 GHz at 15 MHz high channel ,sample plot*

## 8.2.4 Test data, continued

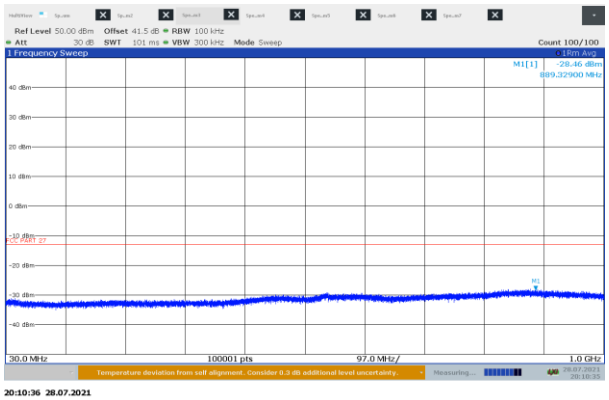



***Figure 8.2-25:*** *Conducted spurious emissions 30 MHz -1 GHz at 15 MHz low 2509 MHz channel ,sample plot*

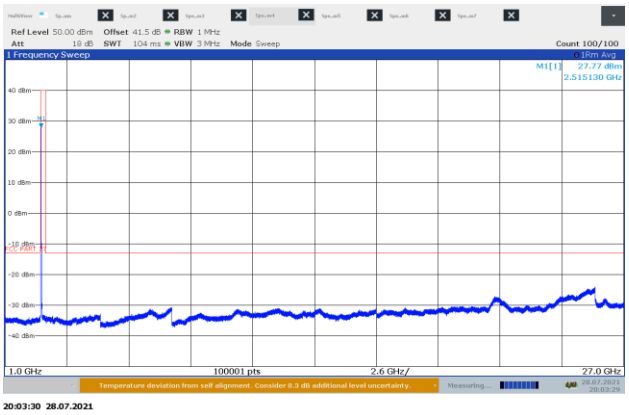



***Figure 8.2-26:*** *Conducted spurious emissions 1 – 27 GHz at 15 MHz low 2509 MHz channel ,sample plot*

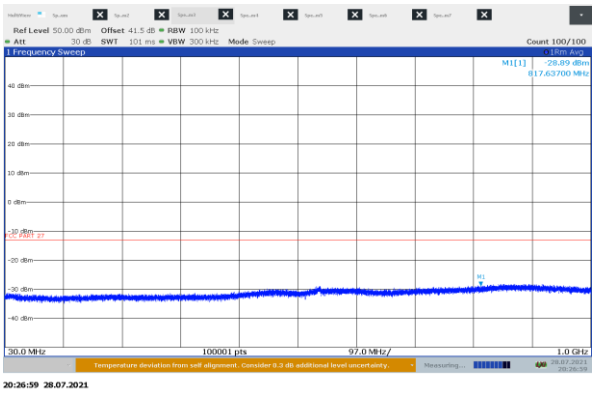



***Figure 8.2-27*** *Conducted spurious emissions 30 MHz -1 GHz at 15 MHz high 2677 MHz channel ,sample plot*

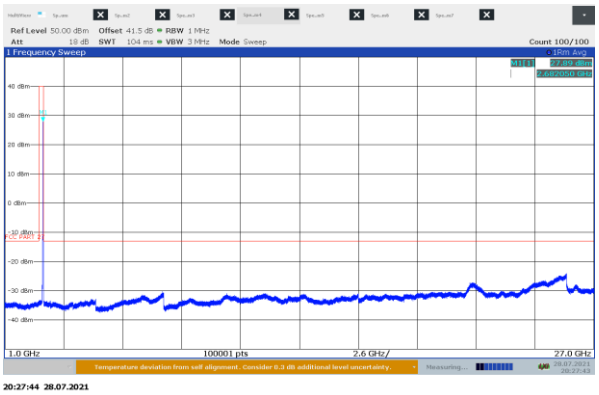



***Figure 8.2-28:*** *Conducted spurious emissions 1 – 27 GHz at 15 MHz high 2677 MHz channel ,sample plot*

## 8.2.4 Test data, continued

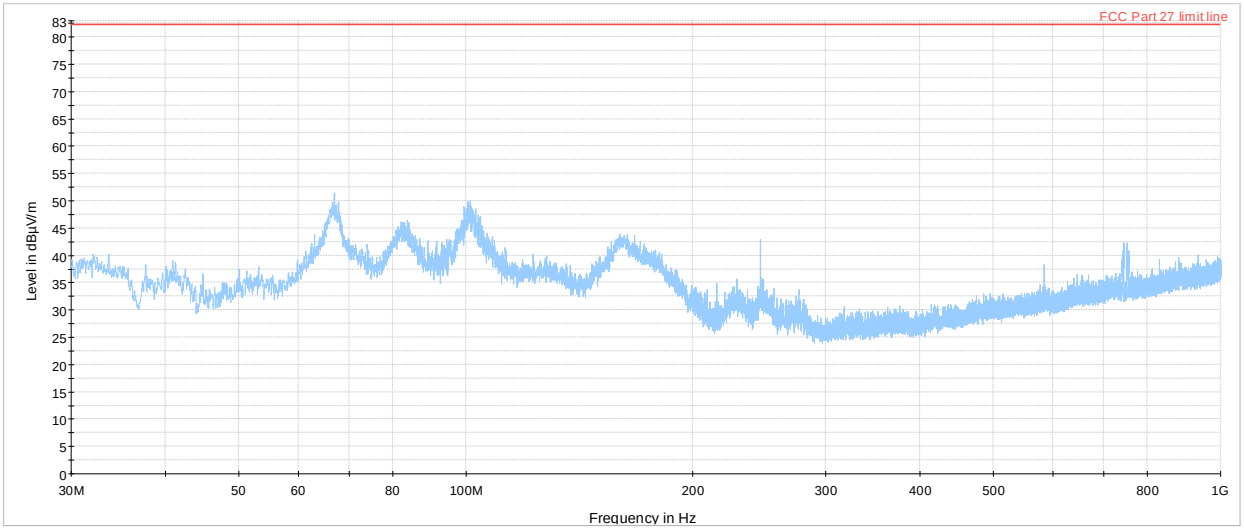



***Figure 8.2-29:*** *Cabinet spurious emissions 30 MHz – 1000 MHz*

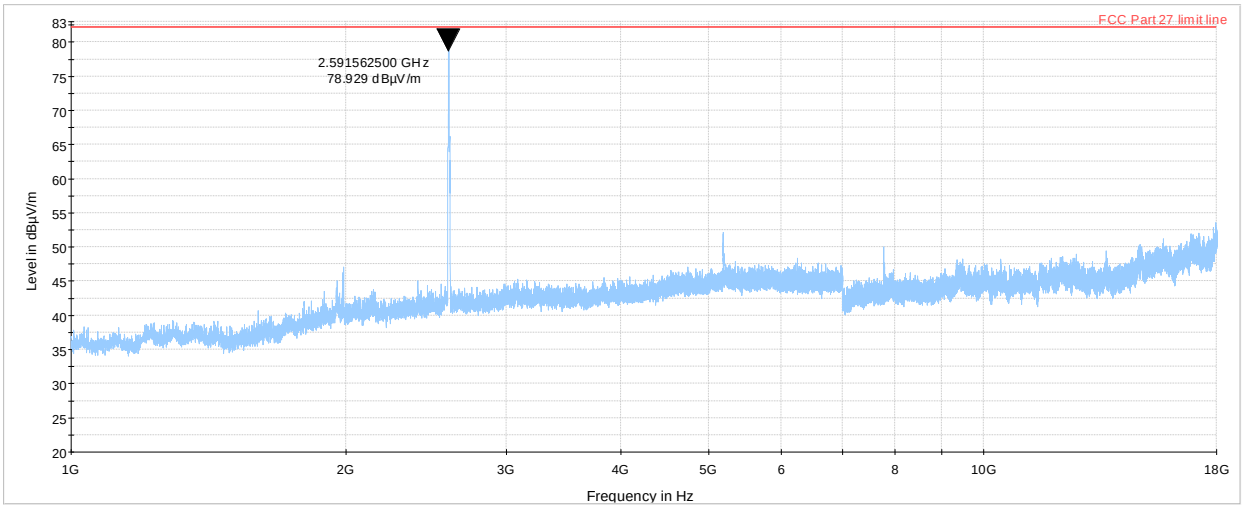



***Figure 8.2-30:*** *Cabinet spurious emissions 1 – 18 GHz*

Note: Emission marked in plot is fundamental frequency of intentional transmitter.

## 8.2.4 Test data, continued

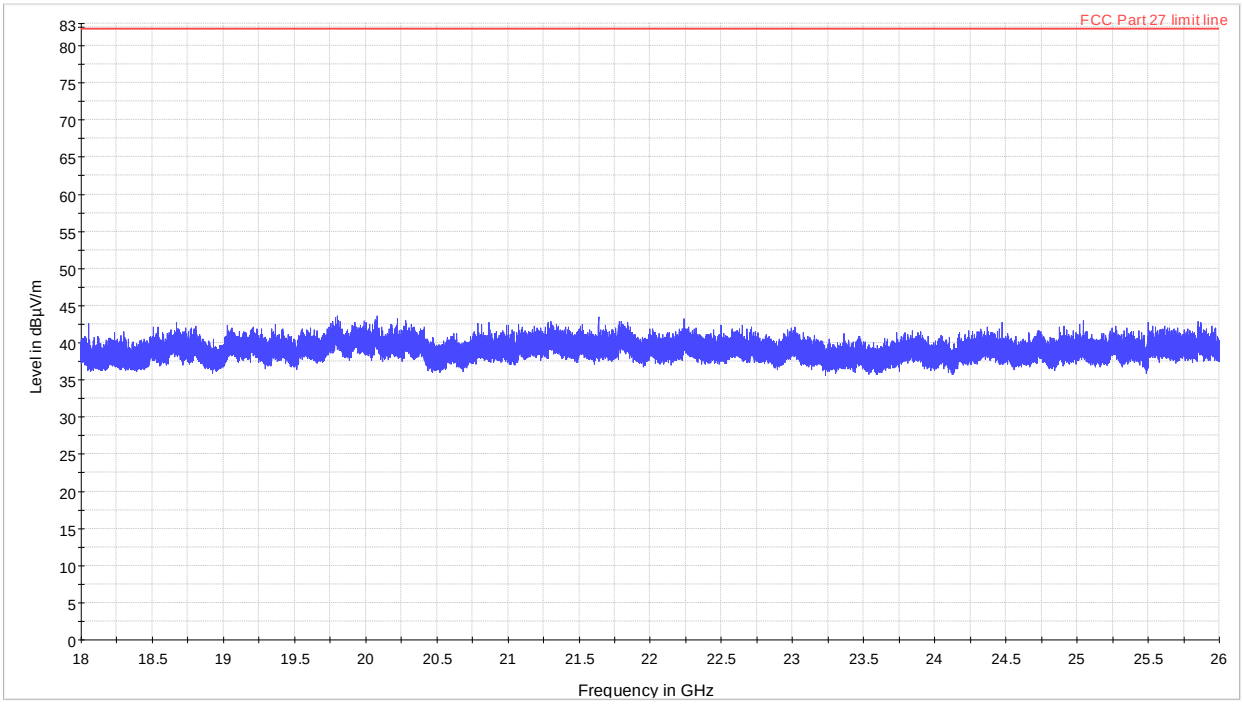



***Figure 8.2-31:*** *Cabinet spurious emissions 18-26 GHz*

## 8.3 FCC 2.1049 Emission bandwidth

### 8.3.1 Definitions and limits

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 8.3.2 Test summary

| | |
|---|---|
| Test date | December 3, 2020 |
| Test engineer | Fahar A Sukkoor |
| Verdict | Pass |

### 8.3.3 Observations, settings and special notes

- 26 dBc points provided in terms of attenuation below unmodulated carrier.
- RBW was set to 1 % of emissions bandwidth.
- Emission bandwidth is measured based on ANSI C 63.26:2015 Clause 5.4.3 Occupied Bandwidth -Relative measurement procedure

| | |
|---|---|
| Resolution bandwidth: | 1% of emission bandwidth |
| Video bandwidth: | 3 X RBW |
| Detector mode: | Peak |
| Trace mode: | Maxhold |

### 8.3.4 Test data

***Table 8.3-1:*** *26 dB BW QPSK modulation results*

| Bandwidth, MHz | Frequency, MHz | Antenna port | 26 dB BW, MHz |
|---|---|---|---|
| 5(low) | 2499 | 1 | 4.81 |
| | | 2 | 4.80 |
| 5(mid) | 2593 | 1 | 4.82 |
| | | 2 | 4.81 |
| 5(high) | 2687 | 1 | 4.82 |
| | | 2 | 4.81 |
| 5(low) | 2502 | 1 | 4.82 |
| | | 2 | 4.78 |
| 5(high) | 2684 | 1 | 4.77 |
| | | 2 | 4.81 |
| 15(low) | 2504 | 1 | 14.06 |
| | | 2 | 14.48 |
| 15(mid) | 2593 | 1 | 14.08 |
| | | 2 | 14.07 |
| 15(high) | 2682 | 1 | 14.16 |
| | | 2 | 14.09 |
| 15(low) | 2509 | 1 | 14.05 |
| | | 2 | 14.16 |
| 15(high) | 2677 | 1 | 14.13 |
| | | 2 | 14.07 |

## 8.3.4 Test data, continued

***Table 8.3-2:*** *26 dB BW 64 QAM modulation results*

| Bandwidth, MHz | Frequency, MHz | Antenna port | 26 dB BW, MHz |
|---|---|---|---|
| 5(low) | 2499 | 1 | 4.83 |
| | | 2 | 4.82 |
| 5(mid) | 2593 | 1 | 4.80 |
| | | 2 | 4.81 |
| 5(high) | 2687 | 1 | 4.80 |
| | | 2 | 4.81 |
| 5(low) | 2502 | 1 | 4.82 |
| | | 2 | 4.80 |
| 5(high) | 2684 | 1 | 4.82 |
| | | 2 | 4.77 |
| 15(low) | 2504 | 1 | 14.33 |
| | | 2 | 14.00 |
| 15(mid) | 2593 | 1 | 14.05 |
| | | 2 | 13.98 |
| 15(high) | 2682 | 1 | 13.96 |
| | | 2 | 14.05 |
| 15(low) | 2509 | 1 | 14.12 |
| | | 2 | 14.08 |
| 15(high) | 2677 | 1 | 14.12 |
| | | 2 | 13.97 |

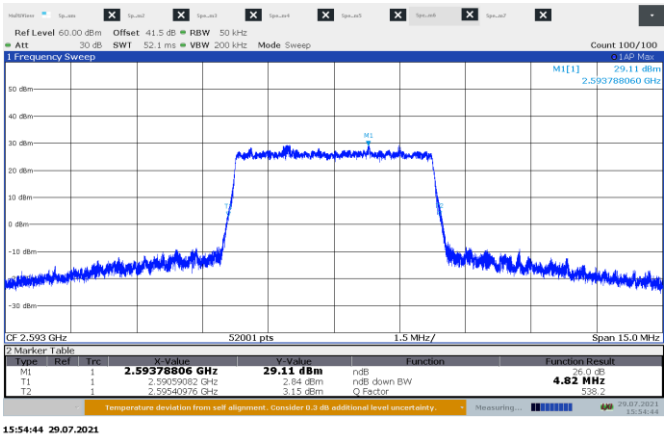



***Figure 8.3-1:*** *26 dB sample plot for 5 MHz channel*

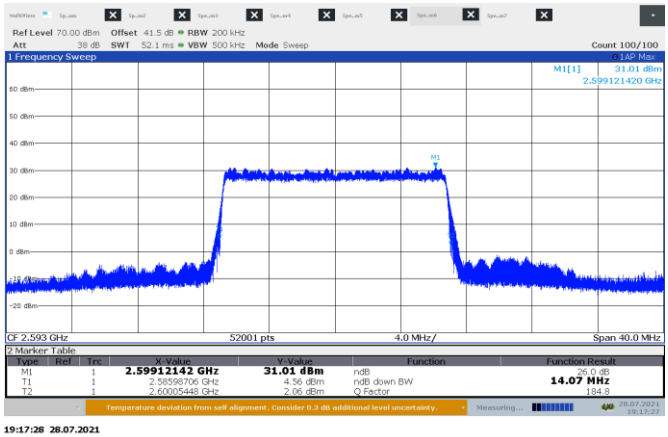
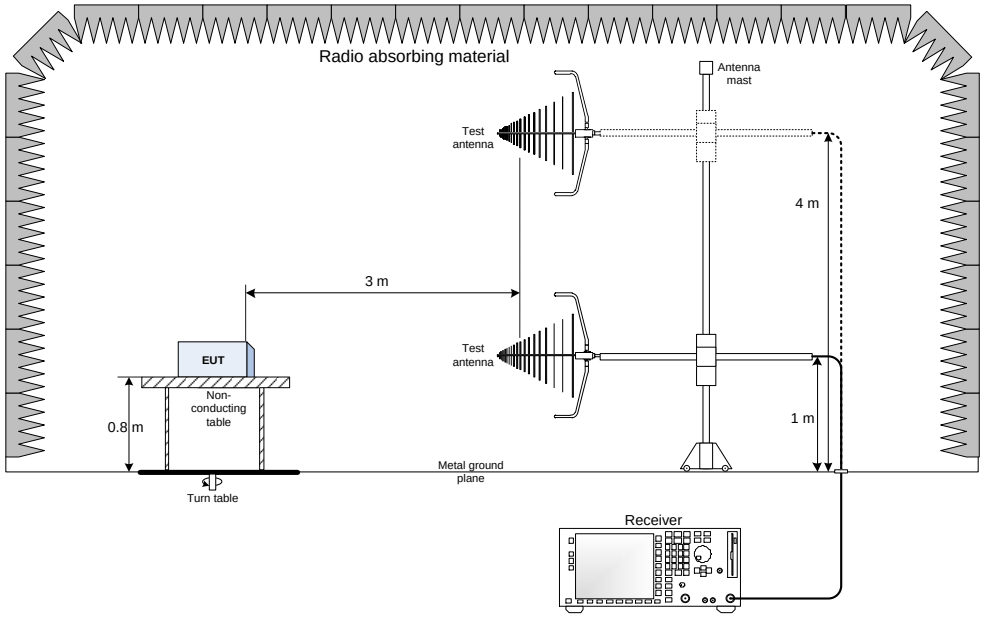


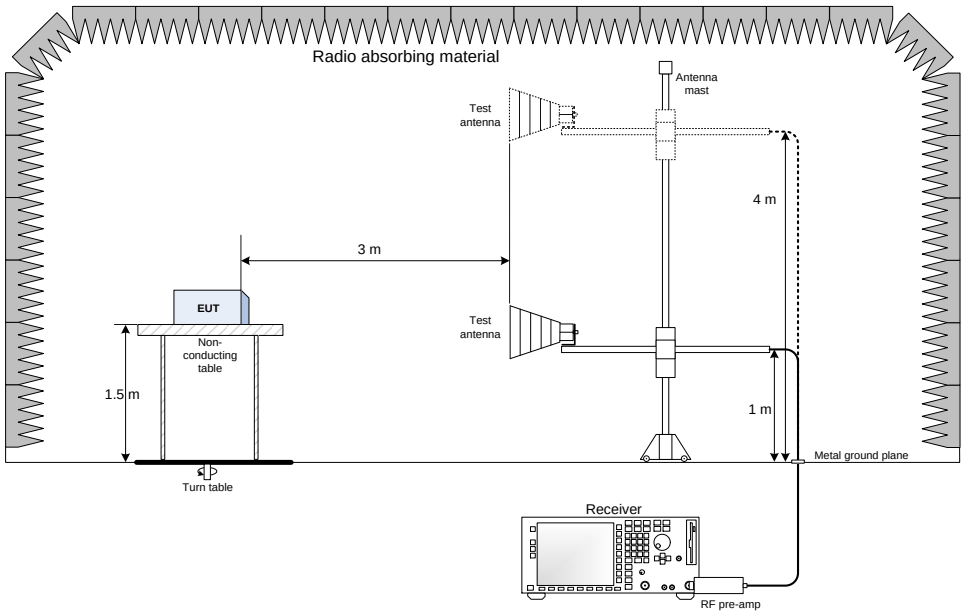

***Figure 8.3-2:*** *26 dB sample plot for 15 MHz channel*

# **Section 9.** Block diagrams of test set-ups

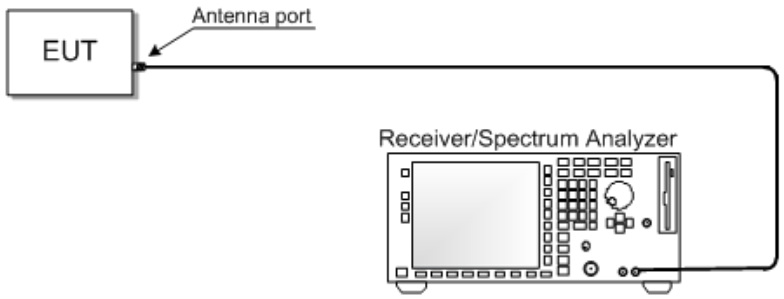
## 9.1 Radiated emissions set-up for frequencies below 1 GHz




## 9.2 Radiated emissions set-up for frequencies above 1 GHz



## 9.3 Conducted emissions set-up




-End of test report -