

# Limited Test report

**463869-9TRFWL**

Date of issue: August 9, 2022

Applicant:

**Foresight Sports**

Product:

**Radio Module**

Model:

**PAN9028 (8987)**

FCC ID: 2A6QA-JODYW263FSS

IC ID: 28505-JODYW263FSS

Specifications:

- ◆ **FCC 47 CFR Part 15, Subpart C – §15.247**  
Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz
- ◆ **Industry Canada RSS-247, Issue 2**  
Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

#### Lab and test locations

|                    |                                                                                   |
|--------------------|-----------------------------------------------------------------------------------|
| Company name       | Nemko USA Inc.                                                                    |
| Address            | 2210 Faraday Ave, Suite 150                                                       |
| City               | Carlsbad                                                                          |
| State              | California                                                                        |
| Postal code        | 92008                                                                             |
| Country            | USA                                                                               |
| Telephone          | +1 760 444 3500                                                                   |
| Website            | www.nemko.com                                                                     |
| FCC Site Number    | Test Firm Registration Number: 392943 Designation Number: US5058                  |
| ISED Test Site     | 2040B-3                                                                           |
| Tested by          | Lan Sayasane, EMC Test Engineer                                                   |
| Reviewed by        | James Cunningham, EMC/MIL/WL Supervisor                                           |
| Review date        | August 9, 2022                                                                    |
| Reviewer signature |  |

#### 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 contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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## Section 1 Report summary

### 1.1 Applicant

|                 |                          |
|-----------------|--------------------------|
| Company name    | Foresight Sports         |
| Address         | 9955 Black Mountain Road |
| City            | San Diego                |
| State           | CA                       |
| Postal/Zip code | 92126                    |
| Country         | USA                      |

### 1.2 Manufacturer

|                 |                          |
|-----------------|--------------------------|
| Company name    | Foresight Sports         |
| Address         | 9955 Black Mountain Road |
| City            | San Diego                |
| State           | CA                       |
| Postal/Zip code | 92126                    |
| Country         | USA                      |

### 1.3 Test specifications

|                                         |                                                                                                                              |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| FCC 47 CFR Part 15, Subpart C – §15.247 | Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz                                                   |
| IC RSS-247 Issue 2                      | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |

### 1.4 Test methods

|                                                           |                                                                                                               |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| ANSI C63.10-2013                                          | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices                |
| 558074 D01 DTS Measurement Guidance v03r02 (June 5, 2014) | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 |

### 1.5 Exclusions

Testing only includes Radiated Spurious and Restricted Band Edge measurements and limited maximum peak conducted power calculations.

### 1.6 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.5 above. 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.

### 1.7 Test report revision history

**Table 1.7-1: Test report revision history**

| Revision #    | Details of changes made to test report |
|---------------|----------------------------------------|
| 463869-9TRFWL | Original report issued                 |
| Notes:        | None                                   |

## Section 2 Summary of test results

### 2.1 FCC Part 15 Subpart C, general requirements

| Part       | Test description          | Verdict    |
|------------|---------------------------|------------|
| §15.207(a) | Conducted limits          | Not tested |
| §15.31(e)  | Variation of power source | Not tested |
| §15.203    | Antenna requirement       | Not tested |

Notes: EUT is AC powered  
The antenna is located within the protective cover of EUT on PCB

### 2.2 FCC Part 15.247

| Part               | Test description                                                                                                           | Verdict           |
|--------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------|
| §15.247(a)(1)(i)   | Frequency hopping systems operating in the 902–928 MHz band                                                                | Not applicable    |
| §15.247(a)(1)(ii)  | Frequency hopping systems operating in the 5725–5850 MHz band                                                              | Not applicable    |
| §15.247(a)(1)(iii) | Frequency hopping systems operating in the 2400–2483.5 MHz band                                                            | Not applicable    |
| §15.247(a)(2)      | Minimum 6 dB bandwidth for systems using digital modulation techniques                                                     | Not tested        |
| §15.247(b)(1)      | Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band        | Pass <sup>1</sup> |
| §15.247(b)(2)      | Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band                                   | Not applicable    |
| §15.247(b)(3)      | Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands | Not applicable    |
| §15.247(b)(4)      | Transmitting antennas of directional gain greater than 6 dBi                                                               | Not applicable    |
| §15.247(c)(1)      | Fixed point-to-point operation with directional antenna gains greater than 6 dBi                                           | Not applicable    |
| §15.247(c)(2)      | Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams                                    | Not applicable    |
| §15.247(d)         | Spurious emissions                                                                                                         | Pass              |
| §15.247(e)         | Power spectral density for digitally modulated devices                                                                     | Not tested        |
| §15.247(f)         | Time of occupancy for hybrid systems                                                                                       | Not tested        |

<sup>1</sup> Limited calculations only

### 2.3 IC RSS-247, Issue 2

| Part    | Test description                                                                       | Verdict           |
|---------|----------------------------------------------------------------------------------------|-------------------|
| 5.1 (a) | Bandwidth of a frequency hopping channel                                               | Not tested        |
| 5.1 (b) | Minimum channel spacing for frequency hopping systems                                  | Not tested        |
| 5.1 (c) | Frequency hopping systems operating in the 902–928 MHz band                            | Not applicable    |
| 5.1 (d) | Frequency hopping systems operating in the 2400–2483.5 MHz band                        | Not tested        |
| 5.1 (e) | Frequency hopping systems operating in the 5725–5850 MHz band                          | Not applicable    |
| 5.2 (a) | Minimum 6 dB bandwidth                                                                 | Not tested        |
| 5.2 (b) | Maximum power spectral density                                                         | Not tested        |
| 5.3 (a) | Digital modulation turned off                                                          | Not tested        |
| 5.3 (b) | Frequency hopping turned off                                                           | Not tested        |
| 5.4 (a) | Frequency hopping systems operating in the 902–928 MHz band                            | Not applicable    |
| 5.4 (b) | Frequency hopping systems operating in the 2400–2483.5 MHz band                        | Pass <sup>1</sup> |
| 5.4 (c) | Frequency hopping systems operating in the 5725–5850 MHz                               | Not applicable    |
| 5.4 (d) | Systems employing digital modulation techniques                                        | Not tested        |
| 5.4 (e) | Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band                       | Not tested        |
| 5.4 (f) | Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams | Not tested        |
| 5.5     | Out-of-band emissions                                                                  | Pass              |

<sup>1</sup> Limited calculations only

### 2.4 IC RSS-GEN, Issue 5

| Part | Test description                                                         | Verdict        |
|------|--------------------------------------------------------------------------|----------------|
| 7.3  | Receiver radiated emission limits                                        | Not applicable |
| 7.4  | Receiver conducted emission limits                                       | Not applicable |
| 8.8  | Power Line Conducted Emissions Limits for License-Exempt Radio Apparatus | Not tested     |

## Section 3 Equipment under test (EUT) details

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### 3.1 Sample information

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|                        |             |
|------------------------|-------------|
| Receipt date           | May 2, 2022 |
| Nemko sample ID number | NEx: 463869 |

### 3.2 EUT information

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|               |                |
|---------------|----------------|
| Product name  | Radio Module   |
| Model         | PAN9028 (8987) |
| Serial number | N/A            |
| Part number   | N/A            |

### 3.3 Technical information

---

|                         |                               |
|-------------------------|-------------------------------|
| Frequency band          | 2400 – 2483.5 MHz             |
| Minimum frequency (MHz) | 2402                          |
| Maximum frequency (MHz) | 2480                          |
| Type of modulation      | GFSK, $\pi/4$ -DQPSK, 8-DPSK  |
| Power requirements      | 16-24 V <sub>DC</sub> ; 1 A   |
| Antenna information     | 2.2 dBi gain, PCB SMT Antenna |

### 3.4 EUT exercise and monitoring details

EUT was tested while modulated on the low, mid, and high channels.

**Table 3.4-1:** EUT sub assemblies

| Description | Brand name       | Model/Part number | Serial number | Rev. |
|-------------|------------------|-------------------|---------------|------|
|             | Foresight Sports |                   | --            | --   |

**Table 3.4-2:** EUT interface ports

| Description | Qty. |
|-------------|------|
| --          | --   |

**Table 3.4-3:** Support equipment

| Description | Brand name | Model/Part number | Serial number | Rev. |
|-------------|------------|-------------------|---------------|------|
| --          | --         | --                | --            | --   |

**Table 3.4-4:** Inter-connection cables

| Cable description | From | To | Length (m) |
|-------------------|------|----|------------|
| --                | --   | -- | --         |

### 3.5 EUT setup diagram



**Figure 3.5-1:** Setup diagram

## Section 4 Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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The following modifications were performed by client:

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5 Test conditions

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### 5.1 Atmospheric conditions

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|                   |            |
|-------------------|------------|
| Temperature       | 15-30 °C   |
| Relative humidity | 20-75 %    |
| Air pressure      | 86–106 kPa |

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

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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  $\pm 5\%$ , for which the equipment was designed.

## Section 6 Measurement uncertainty

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### 6.1 Uncertainty of measurement

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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 |
|-------------------------------|-----------------------------|
| Radiated spurious emissions   | 3.78                        |
| Powerline conducted emissions | 1.38                        |
| All antenna port measurements | 0.55                        |
| Conducted spurious emissions  | 1.13                        |

## Section 7 Test Equipment

**Table 6.1-1: Test Equipment List**

| Equipment         | Manufacturer           | Model no.        | Asset no. | Cal cycle | Next cal.   |
|-------------------|------------------------|------------------|-----------|-----------|-------------|
| EMI Test Receiver | Rohde & Schwarz        | ESU40            | E1131     | 1 year    | 02-Mar-2023 |
| System Controller | Sunol Sciences         | SC 104V          | E1191     | NCR       | NCR         |
| Antenna, Bilog    | Schaffner-Chase        | CBL 6111D        | 1763      | 2 years   | 18-May-2022 |
| Antenna, DRG Horn | ETS-Lindgren           | 3117-PA          | E1139     | 2 years   | 19-Apr-2023 |
| Filter, 2.4GHz    | N/A                    | N/A              | --        | NCR       | NCR         |
| High pass filter  | Wainwright Instruments | WHKX10-5850-6500 | E1208     | NCR       | NCR         |

Notes: NCR - no calibration required

**Table 6.1-2: Test Software**

| Manufacturer of Software | Details                               |
|--------------------------|---------------------------------------|
| Rohde & Schwarz          | EMC 32 V10.60.15 (radiated emissions) |

Notes: None

## Section 8 Testing data

### 8.1 FCC 15.247(b)(1) and RSS-247 5.4(b) Transmitter output power

#### 8.1.1 Definition and limits

Title 47 → Chapter I → Subchapter A → Part 15 → Subpart C → §15.247(b)

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 → 5.4

Devices shall comply with the following requirements, where applicable:

- (b) For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

#### 8.1.1 Test summary

|         |      |
|---------|------|
| Verdict | Pass |
|---------|------|

#### 8.1.2 Notes

No testing was performed. The EIRP was calculated on the basis of test data from the original test report on the "JODY-W2" WLAN and Bluetooth module, report reference MDE\_UBLOX\_2008\_RADIO\_02 (FCC ID: XPYJODYW263, IC: 8595A-JODYW263). EIRP was re-calculated from the original test data using the new manufacturer declared antenna gain.

Manufacturer declared antenna gain: 2.2 dBi.

#### 8.1.3 Test data

**Table 8.1-1: Transmitter output power and EIRP test data**

| Test frequency (MHz) | Operating Mode          | Peak conducted output power (dBm) | Conducted limit (dBm) | Antenna Gain (declared) (dBi) | EIRP (dBm) | EIRP limit (dBm) |
|----------------------|-------------------------|-----------------------------------|-----------------------|-------------------------------|------------|------------------|
| 2402                 | 1-DH5 (GFSK)            | 10.40                             | 30.0                  | 2.2                           | 12.60      | 36.0             |
| 2440                 | 1-DH5 (GFSK)            | 9.60                              | 30.0                  | 2.2                           | 11.80      | 36.0             |
| 2480                 | 1-DH5 (GFSK)            | 9.90                              | 30.0                  | 2.2                           | 12.10      | 36.0             |
| 2402                 | 2-DH5 ( $\pi/4$ -DQPSK) | 10.60                             | 30.0                  | 2.2                           | 12.80      | 36.0             |
| 2440                 | 2-DH5 ( $\pi/4$ -DQPSK) | 9.90                              | 30.0                  | 2.2                           | 12.10      | 36.0             |
| 2480                 | 2-DH5 ( $\pi/4$ -DQPSK) | 10.00                             | 30.0                  | 2.2                           | 12.20      | 36.0             |
| 2402                 | 3-DH5 (8-DPSK)          | 10.80                             | 30.0                  | 2.2                           | 13.00      | 36.0             |
| 2440                 | 3-DH5 (8-DPSK)          | 10.00                             | 30.0                  | 2.2                           | 12.20      | 36.0             |
| 2480                 | 3-DH5 (8-DPSK)          | 10.20                             | 30.0                  | 2.2                           | 12.40      | 36.0             |

## 8.2 FCC 15.247(d) and RSS-247 5.5 Radiated restricted band-edges and spurious emission

### 8.2.1 Definition and limits

Title 47 → Chapter I → Subchapter A → Part 15 → Subpart C → §15.247(d)

- (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247 → §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

**Table 8.2-1: FCC §15.209– Radiated emission limits**

| Frequency,<br>MHz | Field strength of emissions |                                 | Measurement distance, m |
|-------------------|-----------------------------|---------------------------------|-------------------------|
|                   | μV/m                        | dBμV/m                          |                         |
| 0.009–0.490       | 2400/F                      | $67.6 - 20 \times \log_{10}(F)$ | 300                     |
| 0.490–1.705       | 24000/F                     | $87.6 - 20 \times \log_{10}(F)$ | 30                      |
| 1.705–30.0        | 30                          | 29.5                            | 30                      |
| 30–88             | 100                         | 40.0                            | 3                       |
| 88–216            | 150                         | 43.5                            | 3                       |
| 216–960           | 200                         | 46.0                            | 3                       |
| above 960         | 500                         | 54.0                            | 3                       |

Notes: In the emission table above, the tighter limit applies at the band edges.  
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

**Table 8.2-2: FCC restricted frequency bands**

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110       | 16.42–16.423        | 399.9–410     | 4.5–5.15    |
| 0.495–0.505       | 16.69475–16.69525   | 608–614       | 5.35–5.46   |
| 2.1735–2.1905     | 16.80425–16.80475   | 960–1240      | 7.25–7.75   |
| 4.125–4.128       | 25.5–25.67          | 1300–1427     | 8.025–8.5   |
| 4.17725–4.17775   | 37.5–38.25          | 1435–1626.5   | 9.0–9.2     |
| 4.20725–4.20775   | 73–74.6             | 1645.5–1646.5 | 9.3–9.5     |
| 6.215–6.218       | 74.8–75.2           | 1660–1710     | 10.6–12.7   |
| 6.26775–6.26825   | 108–121.94          | 1718.8–1722.2 | 13.25–13.4  |
| 6.31175–6.31225   | 123–138             | 2200–2300     | 14.47–14.5  |
| 8.291–8.294       | 149.9–150.05        | 2310–2390     | 15.35–16.2  |
| 8.362–8.366       | 156.52475–156.52525 | 2483.5–2500   | 17.7–21.4   |
| 8.37625–8.38675   | 156.7–156.9         | 2690–2900     | 22.01–23.12 |
| 8.41425–8.41475   | 162.0125–167.17     | 3260–3267     | 23.6–24.0   |
| 12.29–12.293      | 167.72–173.2        | 3332–3339     | 31.2–31.8   |
| 12.51975–12.52025 | 240–285             | 3345.8–3358   | 36.43–36.5  |
| 12.57675–12.57725 | 322–335.4           | 3600–4400     | Above 38.6  |
| 13.36–13.41       |                     |               |             |

### 8.2.2 Test summary

|               |                                     |                   |           |
|---------------|-------------------------------------|-------------------|-----------|
| Verdict       | Pass                                |                   |           |
| Test date     | May 2, 2022                         | Temperature       | 22 °C     |
| Test engineer | Lan Sayasane, EMC Test Engineer     | Air pressure      | 1008 mbar |
| Test location | 3m semi-anechoic chamber (Radiated) | Relative humidity | 56 %      |

### 8.2.3 Notes

The EUT was configured to transmit continuously on the lowest, middle and highest channels.

The spectrum was search from 30 MHz to 26 GHz (above the 10<sup>th</sup> harmonic of the highest transmit frequency).

Radiated measurements were performed at a 3 m measurement distance.

### 8.2.4 Setup details

|                         |                                                                        |
|-------------------------|------------------------------------------------------------------------|
| EUT setup configuration | Tabletop                                                               |
| Test facility           | Nemko San Diego                                                        |
| Measurement details     | Radiated spurious emissions measurement performed as per C63.10 §11.12 |

Receiver settings for radiated measurements within restricted bands below 1 GHz:

|                      |                                                                |
|----------------------|----------------------------------------------------------------|
| Resolution bandwidth | 120 kHz                                                        |
| Video bandwidth      | 300 kHz                                                        |
| Detector mode        | Peak (preview measurements)<br>Quasi-Peak (final measurements) |
| Trace mode           | Max Hold                                                       |
| Measurement time     | 5 s (final measurements)                                       |

Receiver settings for radiated measurements within restricted bands above 1 GHz:

|                      |                                       |
|----------------------|---------------------------------------|
| Resolution bandwidth | 1 MHz                                 |
| Video bandwidth      | 3 MHz                                 |
| Detector mode        | Average and peak (final measurements) |
| Trace mode           | Max Hold                              |
| Measurement time     | 5 s (final measurements)              |

## 8.2.5 Test data

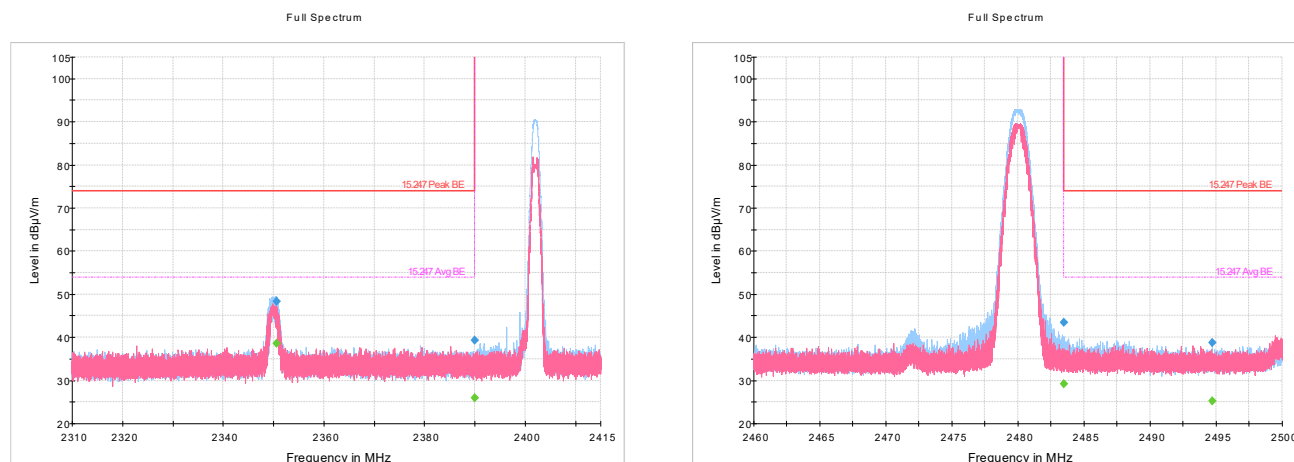


Figure 8.2-1: Radiated emissions, restricted band edge, Bluetooth, DH5

Table 8.2-2: Radiated emissions, restricted band edge, Bluetooth, DH5 (Low Channel)

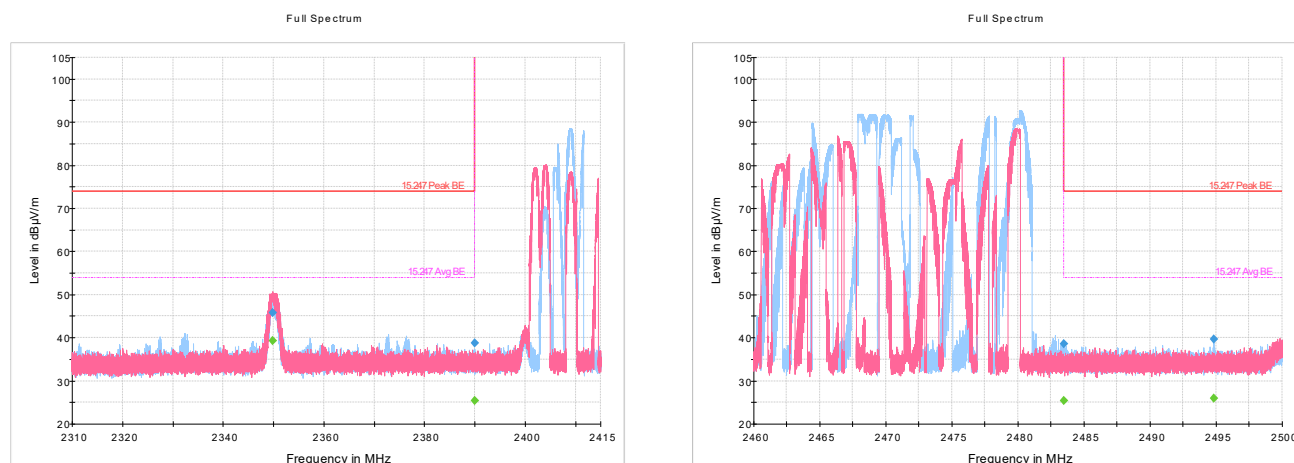
| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 2350.586000     | ---              | 38.65             | 53.90          | 15.25       | 5000.0          | 1000.000        | 386.0       | H   | 178.0         | -10.1        |
| 2350.586000     | 48.40            | ---               | 73.90          | 25.50       | 5000.0          | 1000.000        | 386.0       | H   | 178.0         | -10.1        |
| 2390.000000     | ---              | 26.05             | 53.90          | 27.85       | 5000.0          | 1000.000        | 328.0       | H   | 0.0           | -10.0        |
| 2390.000000     | 39.26            | ---               | 73.90          | 34.64       | 5000.0          | 1000.000        | 328.0       | H   | 0.0           | -10.0        |

Notes: <sup>1</sup> Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)

Table 8.2-3: Radiated emissions, restricted band edge, Bluetooth, DH5 (High Channel)

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 2483.500000     | ---              | 29.23             | 53.90          | 24.67       | 5000.0          | 1000.000        | 334.0       | H   | 258.0         | -9.7         |
| 2483.500000     | 43.46            | ---               | 73.90          | 30.44       | 5000.0          | 1000.000        | 334.0       | H   | 258.0         | -9.7         |
| 2494.685333     | ---              | 25.28             | 53.90          | 28.62       | 5000.0          | 1000.000        | 111.0       | V   | 0.0           | -9.6         |
| 2494.685333     | 38.81            | ---               | 73.90          | 35.09       | 5000.0          | 1000.000        | 111.0       | V   | 0.0           | -9.6         |

Notes: <sup>1</sup> Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)



**Figure 8.2-2:** Radiated emissions, restricted band edge, Bluetooth, DH5 (Hopping)

**Table 8.2-4:** Radiated emissions, restricted band edge, Bluetooth, DH5 (Low Channel - HOPPING)

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 2349.802000     | ---              | 39.37             | 53.90          | 14.53       | 5000.0          | 1000.000        | 384.0       | H   | 172.0         | -10.1        |
| 2349.802000     | 45.81            | ---               | 73.90          | 28.09       | 5000.0          | 1000.000        | 384.0       | H   | 172.0         | -10.1        |
| 2390.000000     | ---              | 25.34             | 53.90          | 28.56       | 5000.0          | 1000.000        | 352.0       | H   | 185.0         | -10.0        |
| 2390.000000     | 38.71            | ---               | 73.90          | 35.19       | 5000.0          | 1000.000        | 352.0       | H   | 185.0         | -10.0        |

Notes: <sup>1</sup> Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)

<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)

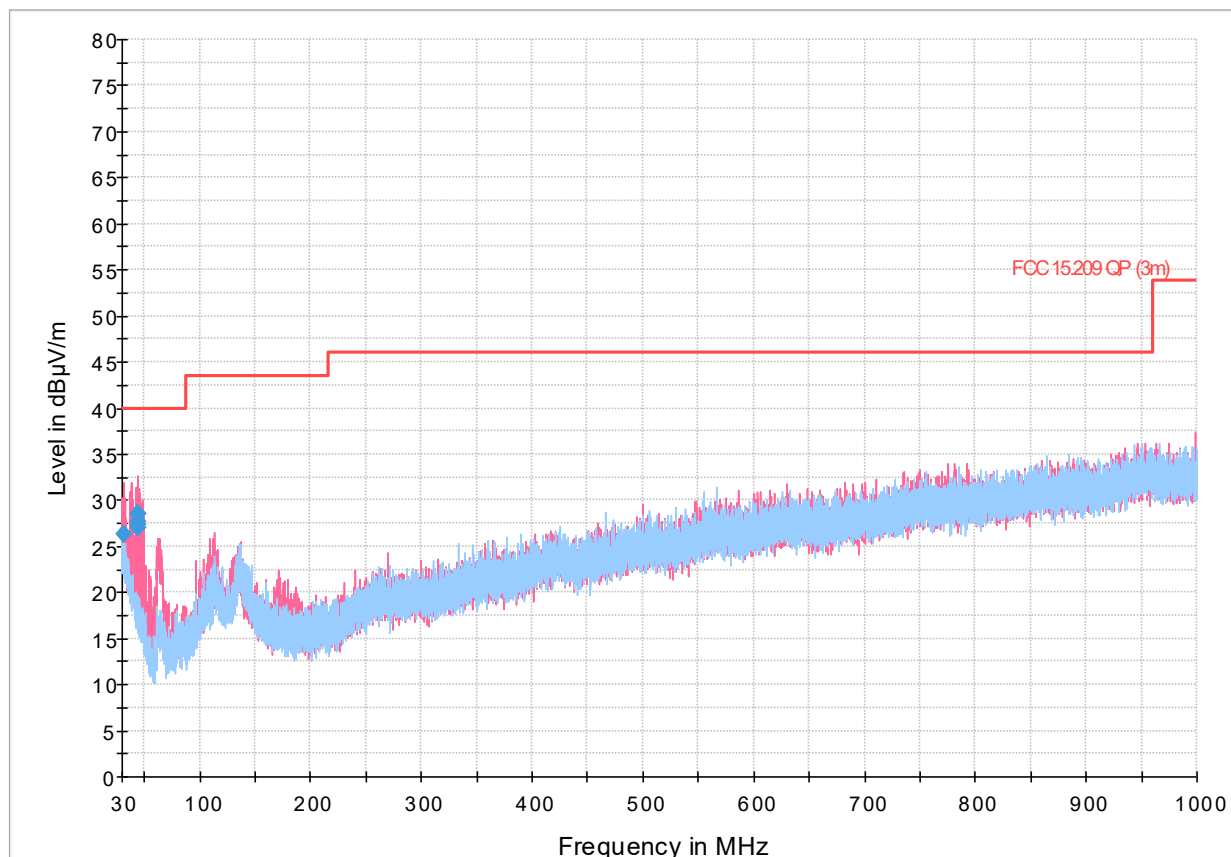
**Table 8.2-5:** Radiated emissions, restricted band edge, Bluetooth, DH5 (High Channel - HOPPING)

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 2483.500000     | ---              | 25.45             | 53.90          | 28.45       | 5000.0          | 1000.000        | 184.0       | H   | 279.0         | -9.7         |
| 2483.500000     | 38.60            | ---               | 73.90          | 35.30       | 5000.0          | 1000.000        | 184.0       | H   | 279.0         | -9.7         |
| 2494.813333     | ---              | 25.88             | 53.90          | 28.02       | 5000.0          | 1000.000        | 371.0       | H   | 282.0         | -9.6         |
| 2494.813333     | 39.67            | ---               | 73.90          | 34.23       | 5000.0          | 1000.000        | 371.0       | H   | 282.0         | -9.6         |

Notes: <sup>1</sup> Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)

<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)

## Full Spectrum



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

**Figure 8.2-3:** Radiated spurious emissions, Bluetooth, DH5, 30-1000 MHz spectral plot (2480 MHz)

**Table 8.2-6:** Radiated spurious emissions, Bluetooth, DH5, 30-1000 MHz (Quasi-Peak) results (2480 MHz)

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 30.987333       | 26.41              | 40.00          | 13.59       | 5000.0          | 120.000         | 100.0       | V   | 230.0         | 26.1         |
| 43.550667       | 27.75              | 40.00          | 12.25       | 5000.0          | 120.000         | 100.0       | V   | 32.0          | 19.3         |
| 44.137000       | 27.41              | 40.00          | 12.59       | 5000.0          | 120.000         | 132.0       | V   | 45.0          | 19.0         |
| 44.142000       | 28.60              | 40.00          | 11.40       | 5000.0          | 120.000         | 100.0       | V   | 33.0          | 19.0         |
| 44.260333       | 28.54              | 40.00          | 11.46       | 5000.0          | 120.000         | 100.0       | V   | 0.0           | 18.9         |
| 44.448333       | 27.01              | 40.00          | 12.99       | 5000.0          | 120.000         | 100.0       | V   | 33.0          | 18.8         |

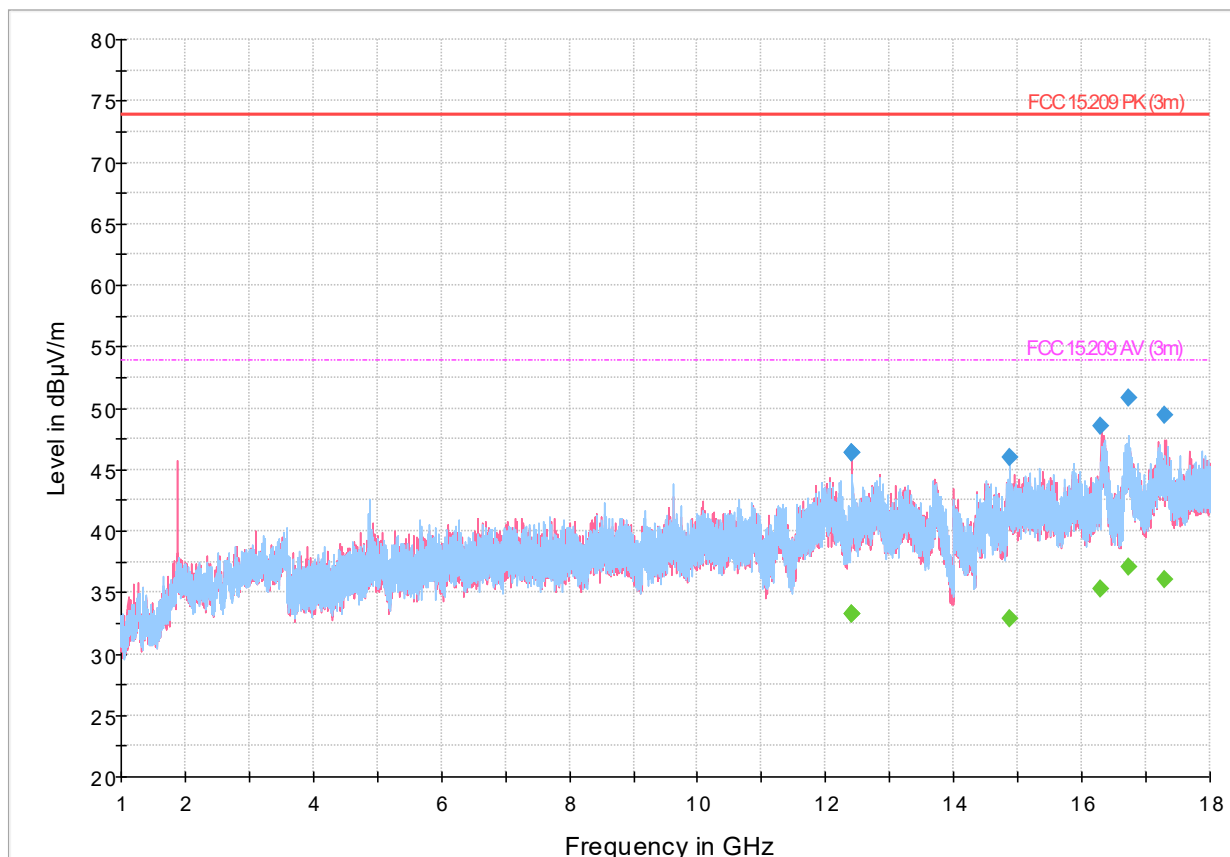
Notes: <sup>1</sup> Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)

<sup>2</sup> Correction factor = antenna factor ACF (dB) + cable loss (dB)

<sup>3</sup> The maximum measured value observed over a period of 5 seconds was recorded.

<sup>4</sup> Limits converted to dBµV/m and an inverse proportionality factor of 20 dB per decade has been used to normalize the specification limit to a measurement distance of 3 meters to determine compliance.

## Full Spectrum



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

**Figure 8.2-4:** Radiated spurious emissions, Bluetooth, DH5, 1-18 GHz spectral plot (2480 MHz)

**Table 8.2-7:** Radiated spurious emissions, Bluetooth, DH5, 1-18 GHz results (2480 MHz)

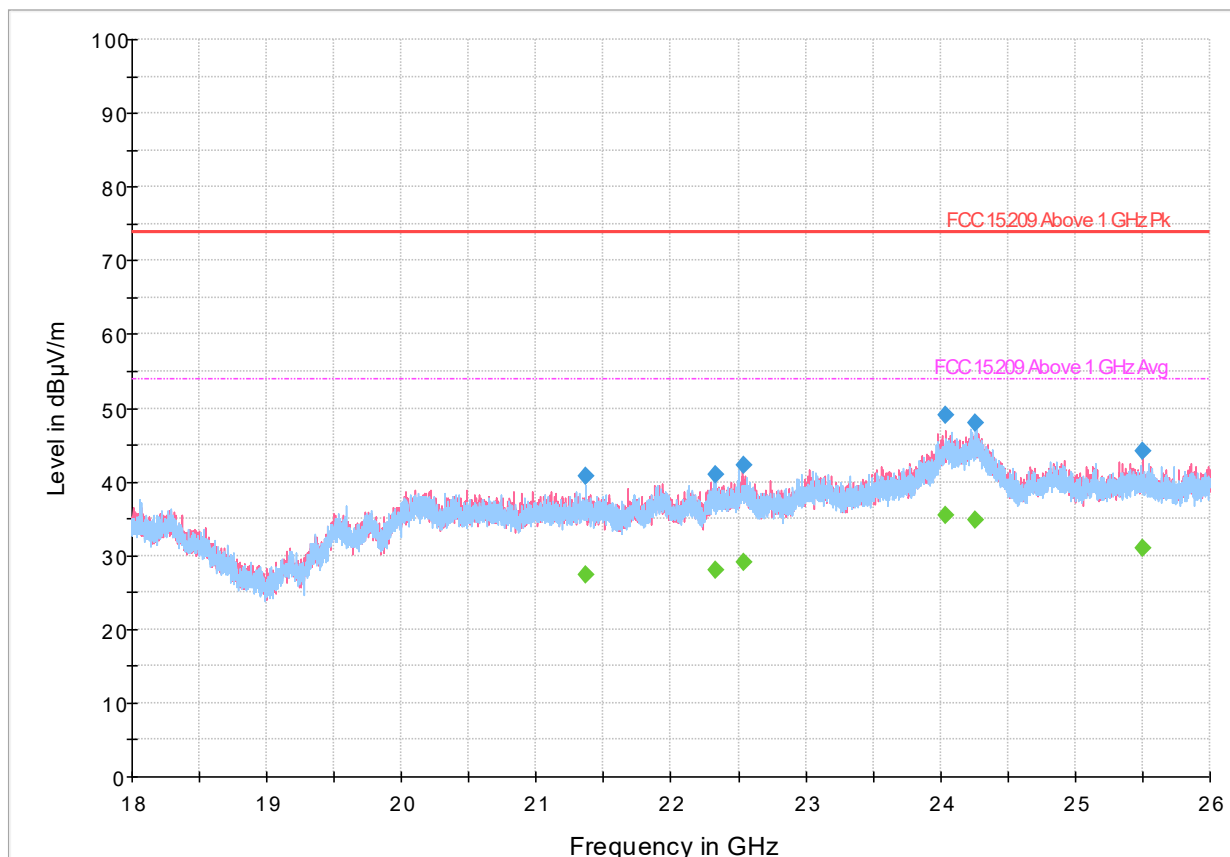
| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 12397.933333    | ---              | 33.22             | 53.90          | 20.68       | 5000.0          | 1000.000        | 141.0       | V   | 93.0          | 7.3          |
| 12397.933333    | 46.31            | ---               | 73.90          | 27.59       | 5000.0          | 1000.000        | 141.0       | V   | 93.0          | 7.3          |
| 12399.533333    | 46.36            | ---               | 73.90          | 27.54       | 5000.0          | 1000.000        | 130.0       | V   | 276.0         | 7.3          |
| 12399.533333    | ---              | 33.23             | 53.90          | 20.67       | 5000.0          | 1000.000        | 130.0       | V   | 276.0         | 7.3          |
| 14880.966667    | 45.97            | ---               | 73.90          | 27.93       | 5000.0          | 1000.000        | 100.0       | H   | 331.0         | 10.3         |
| 14880.966667    | ---              | 32.82             | 53.90          | 21.08       | 5000.0          | 1000.000        | 100.0       | H   | 331.0         | 10.3         |
| 16296.833333    | ---              | 35.23             | 53.90          | 18.67       | 5000.0          | 1000.000        | 144.0       | V   | 210.0         | 13.3         |
| 16296.833333    | 48.47            | ---               | 73.90          | 25.43       | 5000.0          | 1000.000        | 144.0       | V   | 210.0         | 13.3         |
| 16728.600000    | ---              | 37.09             | 53.90          | 16.81       | 5000.0          | 1000.000        | 254.0       | H   | 250.0         | 14.8         |
| 16728.600000    | 50.84            | ---               | 73.90          | 23.06       | 5000.0          | 1000.000        | 254.0       | H   | 250.0         | 14.8         |
| 17291.633333    | ---              | 36.01             | 53.90          | 17.89       | 5000.0          | 1000.000        | 229.0       | V   | 296.0         | 14.9         |
| 17291.633333    | 49.40            | ---               | 73.90          | 24.50       | 5000.0          | 1000.000        | 229.0       | V   | 296.0         | 14.9         |

Notes: <sup>1</sup> Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)

<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)

A 2.4 GHz notch filter was used to remove the fundamental emission

## Full Spectrum



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

**Figure 8.2-5:** Radiated spurious emissions, Bluetooth, DH5, 18-26 GHz spectral plot (2480 MHz)

**Table 8.2-8:** Radiated spurious emissions, Bluetooth, DH5, 18-26 GHz results (2480 MHz)

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| 21371.100000    | 40.77            | ---               | 73.90          | 33.13       | 5000.0          | 1000.000        | 113.0       | H   | 20.0          | 2.4          |
| 21371.100000    | ---              | 27.48             | 53.90          | 26.42       | 5000.0          | 1000.000        | 113.0       | H   | 20.0          | 2.4          |
| 22330.700000    | ---              | 27.96             | 53.90          | 25.94       | 5000.0          | 1000.000        | 175.0       | H   | 56.0          | 2.3          |
| 22330.700000    | 40.97            | ---               | 73.90          | 32.93       | 5000.0          | 1000.000        | 175.0       | H   | 56.0          | 2.3          |
| 22536.100000    | 42.29            | ---               | 73.90          | 31.61       | 5000.0          | 1000.000        | 125.0       | V   | -20.0         | 2.5          |
| 22536.100000    | ---              | 29.14             | 53.90          | 24.76       | 5000.0          | 1000.000        | 125.0       | V   | -20.0         | 2.5          |
| 24037.900000    | 48.96            | ---               | 73.90          | 24.94       | 5000.0          | 1000.000        | 153.0       | V   | 106.0         | 9.2          |
| 24037.900000    | ---              | 35.56             | 53.90          | 18.34       | 5000.0          | 1000.000        | 153.0       | V   | 106.0         | 9.2          |
| 24256.100000    | 47.93            | ---               | 73.90          | 25.97       | 5000.0          | 1000.000        | 147.0       | H   | 116.0         | 9.4          |
| 24256.100000    | ---              | 34.92             | 53.90          | 18.98       | 5000.0          | 1000.000        | 147.0       | H   | 116.0         | 9.4          |
| 25496.700000    | ---              | 30.90             | 53.90          | 23.00       | 5000.0          | 1000.000        | 125.0       | V   | 230.0         | 4.3          |
| 25496.700000    | 44.16            | ---               | 73.90          | 29.74       | 5000.0          | 1000.000        | 125.0       | V   | 230.0         | 4.3          |

Notes: <sup>1</sup> Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)

<sup>2</sup> Correction factors = antenna factor ACF (dB) + cable loss (dB) – pre-amp (dB)

## Section 9 Block diagrams of test set-ups

### 9.1 Radiated emissions set-up

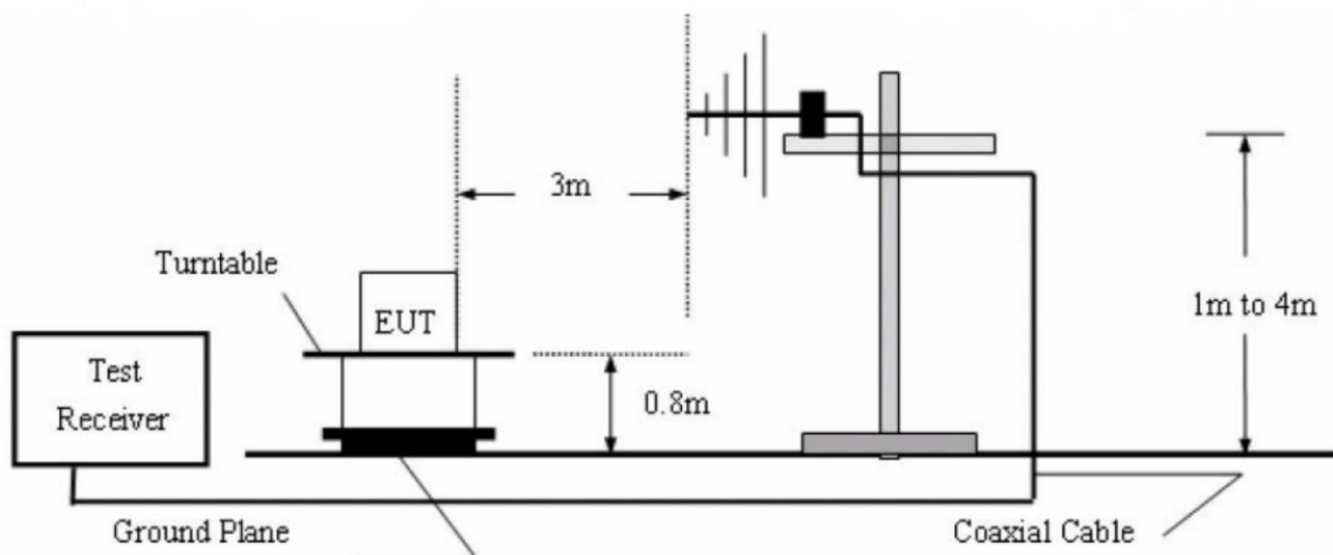


Figure 9.1-1: 30 MHz - 1000 MHz Setup

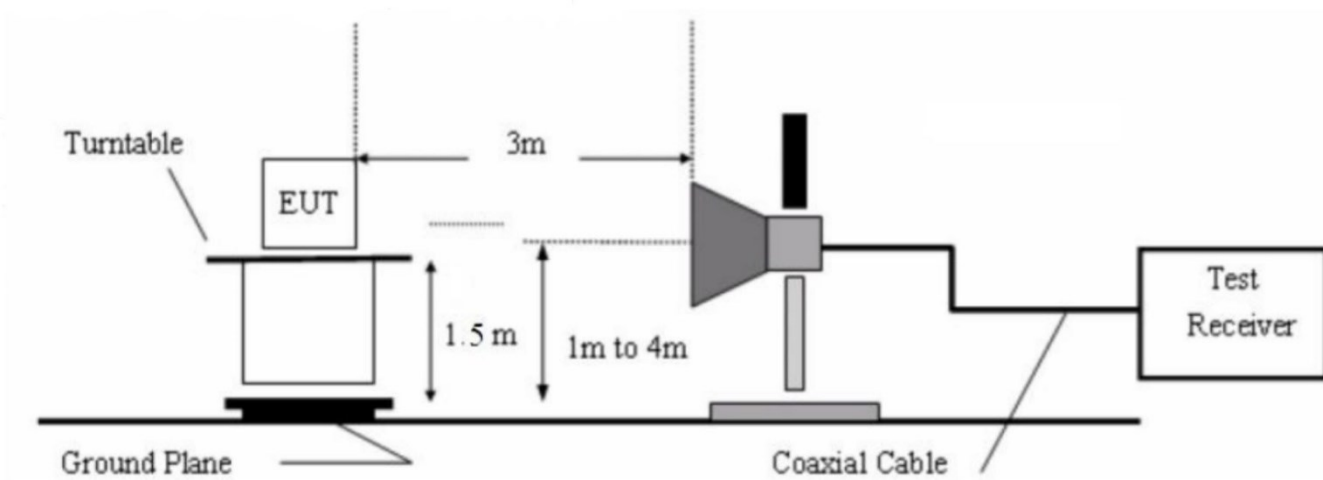


Figure 9.1-2: 1 GHz - 26 GHz Setup