FLEXTRONICS
Design Validation Centre

# Radiated Emissions Report for:
# Ericsson RD 2242 B2 LTE & WCDMA

**Test Object**

**Product Name: RD 2242 B2**

**Product Number: KRY 901 328/1**

**Document number:** **K002569-TR-EMC-07-R1**

**Prepared for:** **Ericsson Canada**

## Report Summary:

| Standard | Requirement | Compliant |
|---|---|---|
| FCC part 2.1053, 2.1057<br>FCC Part 24.238 | Spurious Emissions | Yes |
| RSS-133 Section 6.5<br>RSS-GEN 6.13 | Transmitter Unwanted Emissions | Yes |


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The Design Validation Centre (DVC) is accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at http://palcan.scc.ca/Specs/PDF/95_e.pdf. The DVC is accredited to FCC Part 2, FCC Part 24 and RSS-133 and RSS-GEN.

## Document revision control

| Release | Date | Description |
|---|---|---|
| 01 | July 14, 2015 | Initial release |

## Test lab information

| | |
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# 1. Executive Summary

This document reports the Radiated Emissions results performed by the Flextronics Design Verification Centre (DVC) on the Ericsson RD 2242 B2 product. The RD 2242 is a Radio Unit (RU) forming part of the Ericsson's RBS equipment consisting of a Digital Unit (DU), Indoor Radio Unit (IRU 2242) and the Radio DOT (RD 2242).

The RD 2242 B2 was subjected to assessment while operating at the RBS (System) level and was found compliant to the spurious radiated emissions requirements of FCC Part 2, FCC Part 24, RSS-133 & RSS-GEN.

# 2. Product Details

The Test Object is a RD 2242 B2 (Radio DOT) designed for use in LTE/WCDMA Radio Base Station (RBS) equipment. The RD 2242 product provides the radio access for mobile and fixed devices and is intended for the indoor environment. The RD 2242 B2 (Radio DOT) Unit (MSR) supports single carrier (SC), multi-carrier (MC) and multi-standard (MSR) LTE, WCDMA.

The RD 2242 is connected to an Indoor Radio Unit (IRU 2242) by CAT6 cable (RDI Interface) which provides the IF interface and DC power. The RBS / RDS (Radio Dot System) consists of the RD 2242, IRU 2242 and DUS (Digital Unit Multi-standard) and DUW (Digital Unit - WCDMA).

**Table 1: RD 2242 B2 Radio Unit Details**

| **Model:** | **RD 2242 B2** |
|---|---|
| Part No. | KRY 901 328/1 |
| Antenna Ports: | 2 TX/RX Ports |
| IBW: | 40MHz |
| FDD: | 80MHz |
| Frequency: | TX (DL): 1930 - 1990MHz |
| | RX (UL): 1850 – 1910MHz |
| Nominal O/P per Antenna Port: | Single Carrier: 1 x 50mW (17dBm) |
| | Multi-Carrier: 2 x 25mW (14dBm) |
| | Multi-Carrier: 3 x 16.7mW (12.2dBm) |
| | Multi-Carrier: 4 x 12.5mW (11dBm) |
| | Multi-Carrier: 5 x 10mW (10dBm) |
| | Multi-Carrier: 6 x 8.3mW (9.2dBm) |
| Accuracy (Nominal): | +/- 0.1 PPM |
| Nominal Voltage: | -48 VDC @ 0.5A |
| RAT: | LTE: SC, MC |
| | WCDMA: SC, MC |
| | Multi RAT W + L: SC, MC |
| Modulation: | LTE: QPSK, 16QAM, 64QAM |
| | WCDMA: QPSK, 16QAM, 64QAM |
| Channel Bandwidth: | LTE: 5, 10, 15, 20MHz |
| | WCDMA: 4.2 to 5MHz |
| Maximum Combined OBW per Port: | 40MHz |
| IF Interface: | DL: 110 – 150MHz |
| | UL: 40 – 80MHz |
| Channel Raster: | LTE = 100kHz, WCDMA = 200kHz |
| Regulatory Requirements: | FCC: CFR 47 Part 2, 24 |
| | EMC: CFR 47 Part 15 |
| | IC: RSS-GEN, RSS-133 |
| | EMC: ICES-003 |
| Multi-carrier: | MIMO 2 x 2, TX Diversity |
| Regulatory ID: | FCC: TA8BKRY901328-1 |

| Model: | RD 2242 B2 |
|---|---|
| | IC: 287AB-BS9013281 |
| | IC Model: BS9013281 |
| Operating Temperature: | +5°C to +40°C |
| Total Power based on IBW: | 2 x 50mW |
| Supported Carrier Configurations: | LTE BW=5, 10, 15, 20 (1-2), WCDMA= (1-4) |
| MSR Maximum Carrier Configurations: | 40MHz |

**Figure 1: RD 2242 Product identification label**


**Table 2: EUT inventory**

| Product | Product number | Release number | Serial number |
|---|---|---|---|
| RD 2242 B2 | KRY 901 328/1 | R2C | C829931567 |

Photographs of the test setup are presented in Appendix A: Test setup photographs on page 37.

## 2.1 System modifications

The Equipment Under Test (EUT) was not modified.

## 2.2 Power and grounding requirements

DC Power and ground is provided via the RDI (Radio DOT Interface) cable.

## 2.3 Product port definition and EUT cable information

**Table 3: System port definition**

| Port or cable designation | Interface description | Permanent connection | Shielded cable | Max cable length (m) | Max quantity |
|---|---|---|---|---|---|
| RDI | CAT6a IF Interface | Yes | Yes | 100 | 1 |
| RF Test Port A/B | Coaxial | No | Yes | NA | 2 |

## 2.4 RDS 2242 Software

The software listed below was used to operate the EUT.

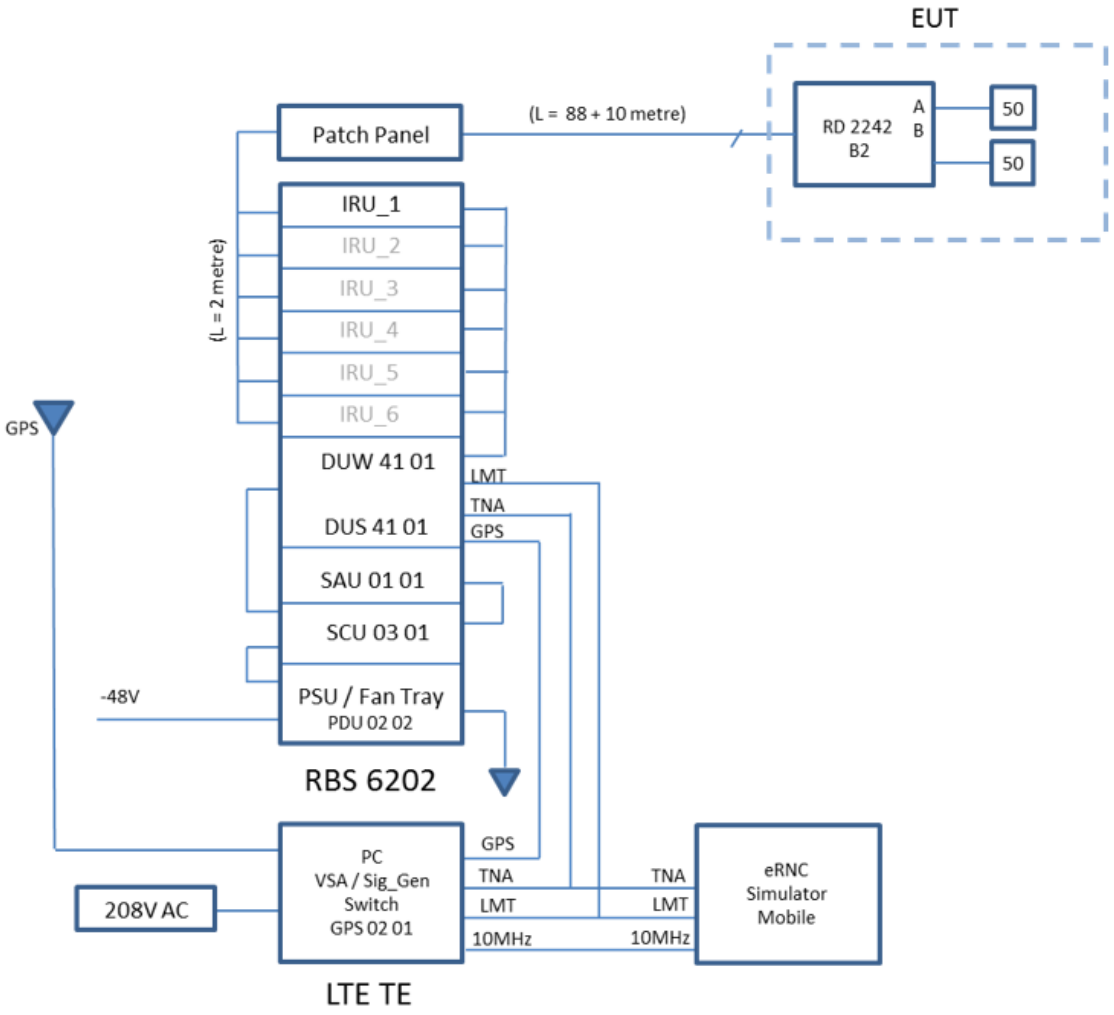
- IRU + RD: R60GY
- DU (LTE) : R55BU
- DU (WCDMA) : R5DA23

## 2.5 Support equipment

| Product Name | Product # | R-state | Serial Number # |
|---|---|---|---|
| RBS-6202 | BYB 911 40/1 | R3B | TU8J612974 |
| PDU 02 02 | BMG 980 336/5 | R1V | C941678186 |
| DUS 41 01 | KDU 137 624/1 | R7B | CD38327641 |
| DUW 41 01 | KDU 127 174/4 | R2E | TU8XP27523 |
| SCU 03 01 | BGM 136 1006/3 | R1B | CR98104694 |
| PFU 02 02 | KFE 101 1162/3 | R1C | R82763452 |
| Patch Panel | BGK 901 55/1 | | |
| IRU 2242 | KRC 161 444/1 | R2B | C829886786 |

## 2.6 System Configuration

**Figure 2: LTE and WCDMA setup for emissions testing**



# 3. Radiated Emission Measurements

## 3.1 Description of test facilities

Emissions (RE) testing is performed in a 10-meter Ambient Free Chamber (AFC). The AFC consists of a shielded room lined with ferrite tiles and anechoic material.

The temperature and humidity in these test facilities are controlled and maintained between 15 ºC and 35 ºC with a relative humidity between 30 % and 60 %. Levels are recorded and any exceptions are included in the detailed test results sections of this report.

The facility is located at 1280 Teron Road, Ottawa, Ontario, Canada, K2K 2C1.

## 3.2 Test specification and limits

**Table 4: Spurious radiated emissions requirements**

| Test Method | Associated standand |
|---|---|
| RSS-133 Section 6.5 | RSS-GEN Section 6.13 |
| FCC Part 2.1053, 2.1057 | ANSI C63.4 [2], TIA-603-C [3] |
| FCC Part 24.238 | ANSI C63.4 [2], TIA-603-C [3] |

### 3.2.1 RSS-133 Section 6.5 Transmitter Unwanted Emissions.

*RSS-133 6.5.1 Out-of-Block Emissions*

*Equipment shall comply with the limits in (i) and (ii) below.*

*(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).*

*(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.*

### 3.2.2 FCC Part 2.1053 Measurements required: Field strength of spurious radiation.

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

*Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.*

### 3.2.3 FCC Part 2.1057 Frequency spectrum to be investigated.

*The spectrum should be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Particular attention should be paid to harmonics and sub harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked. The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported.*

### 3.2.4 FCC Part 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

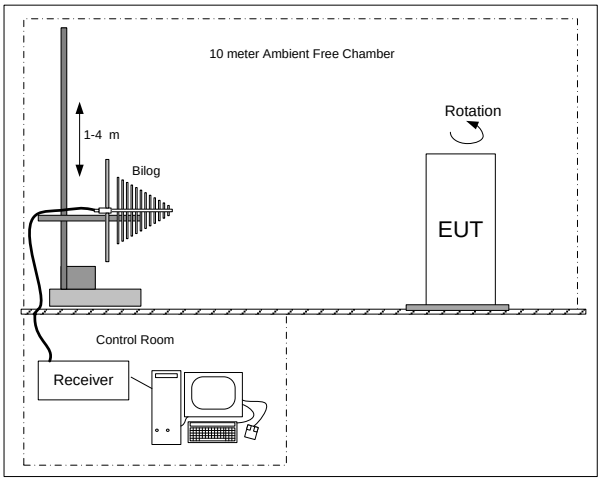
(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). 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.

## 3.3 Test procedure

- For pre-measurements between **30 MHz and 1 GHz** the receive antenna (bi-log) was placed 3 m away from the EUT. An initial scan was performed to find emissions (frequencies) requiring detailed measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 m, and for horizontal and vertical polarizations of the receiving antenna.
- For pre-measurements between **1 GHz and 10 GHz** the receive antenna (horn) was placed 3 m away from the EUT. An initial scan was performed to find emissions (frequencies) requiring detailed measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 m, and for horizontal and vertical polarizations of the receiving antenna.
- For pre-measurements between **10 GHz to 18 GHz** the receive horn antenna was placed at a 3 m distance from the EUT. An initial scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 m, and for horizontal and vertical polarizations of the receiving antenna. These measurements were made with an average detector mode (AVG) with 1 MHz bandwidth unless otherwise noted.
- For pre-measurements between **18 GHz to 40 GHz** the receive horn antenna was placed at a 1 m distance from the EUT. An initial scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan was performed manually in close proximity to the EUT to find any system emissions in this frequency band. This search was performed on four sides of the EUT, along the entire height of the EUT, using both polarization of the receive antenna. Final measurements were made with an average detector mode (AVG) with 1 MHz bandwidth unless otherwise noted.
- The EUT was placed on a non-conducting support in the semi anechoic chamber.
- For **all the above frequency ranges** optimization was performed based on the pre-scan data. For each identified frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 m at this azimuth to obtain maximum emissions. The procedure was repeated for both horizontal and vertical polarizations (where applicable) of the search antenna. The maximum level measured was recorded. The spectrum analyzer was verified to make sure it was not saturating in the presence of the radio signal.
- The highest emissions were re-evaluated using the substitution method. This is accomplished by replacing the EUT by a calibrated antenna, cable and signal generator. This equipment is used to transmit a signal that will generate a RF meter reading level identical to the one recorded when the EUT was present for the optimization.

**Figure 3: Setup for pre-measurements**




### 3.3.1 Calculation of the compliance margin

The following parameters and coefficients are used to calculate and derive compliance levels and margins with respect to measurement results and test parameters. The example below illustrates the manner in which the field strength emissions levels are calculated.

| | |
|---|---|
| Meter Reading (dBµV) = | Voltage measured using the spectrum analyzer with quasi-peak adapter |
| Gain/Loss Factor (dB) = | Cumulative gain or loss of pre-amplifier and cables used in the measurement path (a negative value indicates gain) |
| Correction (dB) = | Gain/Loss Factor (dB) + Antenna factor (dB) |
| Level (dBµV/m) = | Corrected value or field strength, that is, the parameter of interest that is compared to the limit |
| Margin (dB) = | Level with respect to the appropriate limit (a positive Margin indicates that the Level is below the limit and that the measurement is a PASS) |

The Level values are calculated as follows:

Level = Meter Reading + Correction (dB)

The Margin values are calculated as follows:

**ERP = Effective Radiated Power or Equivalent Radiated Power**

**ERP (dBm) = Signal generator level (dBm) – Cable losses (dB) + Antenna gain (dBi) – half wave dipole gain (2.15 dB)**

**Margin = Limit – ERP**

**dBi to dBd conversion factor is 2.15**

### 3.3.2 Measurement uncertainties

Uncertainty evaluation for pre-measurements has been calculated according to the method described in CISPR 16 for pre-measurements. The expanded measurement instrumentation

uncertainty (with a 95 % level of confidence) on E-field RE is: ± 3.8 dB between 30 MHz and 1 GHz, ± 4.7 dB between 1 GHz and 10 GHz, 4.8 dB between 10 GHz and 18 GHz and 4.6 dB between 18 GHz and 26.5 GHz

### 3.3.3 EUT modes of operation

The RD 2242 B2 was tested over Single and Multi-RAT configurations for Single and Multi-carrier compliance assessment. Carrier power (per port) for Single and Multi-carrier is referenced in Table 1. The RD 2242 B2 was operated with both transmitters

Band 2 (IBW = 40 MHz)

TX (DL): 1930 - 1990MHz
RX (UL): 1850MHz – 1910MHz
Duplex Spacing: 80MHz
RFBW: 60MHz
Test Model: LTE: E-TM1.1 , WCDMA: TM3

**Test Frequencies:**

*LTE Supported Carrier Configurations:* *BW=5,10,15,20 (1-2)*

***LTE Single Carrier***

| Bandwidth | Transmit / DL (MHz) | | | | | | Receive / UL (MHz) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | | M | | T | | B | | M | | T | |
| (MHz) | EARFCN | Frequency | EARFCN | Frequency | EARFCN | Frequency | EARFCN | Frequency | EARFCN | Frequency | EARFCN | Frequency |
| 5 | 625 | 1932.5 | 900 | 1960 | 1175 | 1987.5 | 18625 | 1852.5 | 18900 | 1880.0 | 19175 | 1907.5 |
| 10 | 650 | 1935.0 | 900 | 1960 | 1150 | 1985.0 | 18650 | 1855.0 | 18900 | 1880.0 | 19150 | 1905.0 |
| 15 | 675 | 1937.5 | 900 | 1960 | 1125 | 1982.5 | 18675 | 1857.5 | 18900 | 1880.0 | 19125 | 1902.5 |
| 20 | 700 | 1940.0 | 900 | 1960 | 1100 | 1980.0 | 18700 | 1860.0 | 18900 | 1880.0 | 19100 | 1900.0 |

***LTE Multi-Carrier (Spurious Emissions)***

| Bandwidth | Transmit/DL (MHz) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | EARFCN | B1 | EARFCN | B2 | EARFCN | M1 | EARFCN | M2 | EARFCN | T1 | EARFCN | T2 |
| 5 | 625 | 1932.5 | 975 | 1967.5 | 725 | 1942.5 | 1075 | 1977.5 | 825 | 1952.5 | 1175 | 1987.5 |
| 10 | 650 | 1935.0 | 950 | 1965.0 | 750 | 1945.0 | 1050 | 1975.0 | 850 | 1955.0 | 1150 | 1985.0 |
| 15 | 675 | 1937.5 | 925 | 1962.5 | 775 | 1947.5 | 1025 | 1972.5 | 875 | 1957.5 | 1125 | 1982.5 |
| 20 | 700 | 1940.0 | 900 | 1960.0 | 800 | 1950.0 | 1000 | 1970.0 | 900 | 1960.0 | 1100 | 1980.0 |

*WCDMA Supported Carrier Configurations:* *BW=4.2, 5 (1-4)*

***WCDMA Single Carrier***

| Bandwidth | Transmit / DL (MHz) | | | | | | Receive / UL (MHz) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | | M | | T | | B | | M | | T | |
| (MHz) | ARFCN | Frequency | ARFCN | Frequency | ARFCN | Frequency | ARFCN | Frequency | ARFCN | Frequency | ARFCN | Frequency |
| 5 | 9662 | 1932.4 | 9800 | 1960 | 9938 | 1987.6 | 9262 | 1852.4 | 9400 | 1880.0 | 9538 | 1907.6 |

***WCDMA Multi-Carrier (Spurious Emissions)***

| Bandwidth | Transmit / DL (MHz) | | | | Transmit / DL (MHz) | | | | Transmit / DL (MHz) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | B1 | B2 | B3 | B4 | M1 | M2 | M3 | M4 | T1 | T2 | T3 | T4 |
| 5 | 1932.4 | 1937.4 | 1962.6 | 1967.6 | 1942.4 | 1947.4 | 1972.60 | 1977.60 | 1952.4 | 1957.4 | 1982.60 | 1987.60 |
| ARFCN | 9662 | 9687 | 9813 | 9838 | 9692 | 9737 | 9863 | 9888 | 9762 | 9787 | 9913 | 9938 |

## 3.4 Test Results

Test Details: Tested June 29th-July 6th 2015 in the DVC 10-meter AFC by Van-Duc Phan.

LTE test configurations with 5, 10, 15, and 20 MHz channel bandwidth of were investigated. The 5 MHz channel bandwidth had the highest emissions. WCDMA test results for bottom, middle, and top channels are all included in this report.

### 3.4.1 WCDMA, Single Carrier, 16 QAM, Bottom

**Figure 4: RE at 3 m from 30 MHz to 1 GHz (WCDMA, 1C, 16QAM, BOT)**

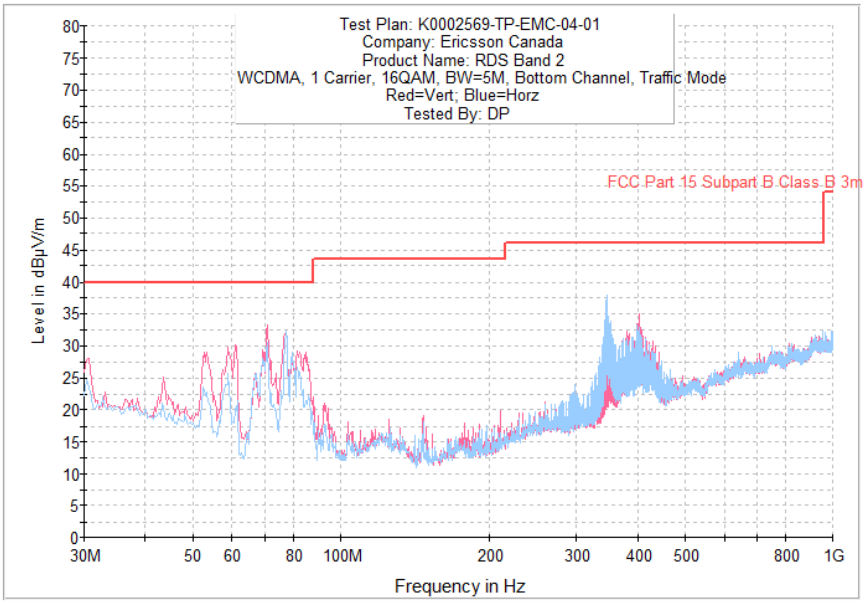
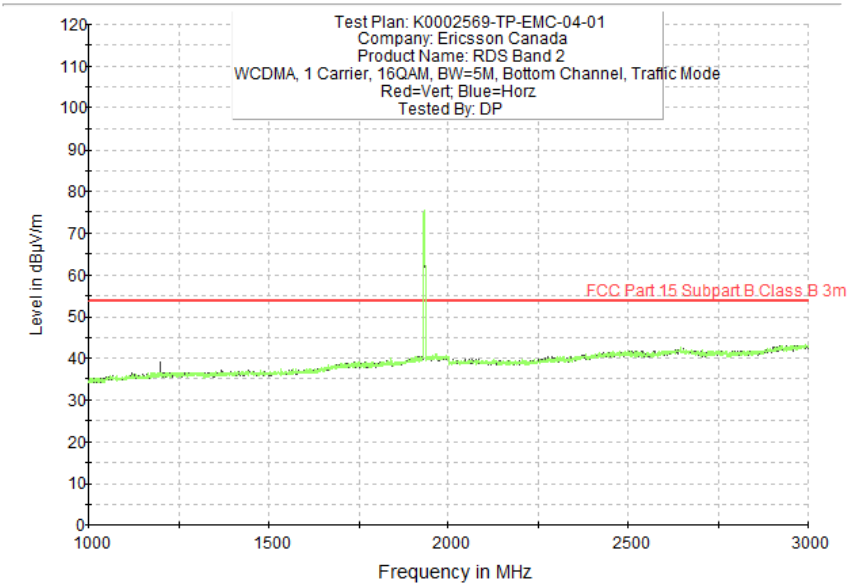



**Table 5: E-field RE test results (30 to 1000 MHz) (LTE, 1C, QPSK, BOT)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 61.053750 | 23.9 | quasi-peak | 102 | V | 21 | 11.5 |
| 71.003250 | 29.0 | quasi-peak | 103 | V | 272 | 8.3 |
| 77.636250 | 29.0 | quasi-peak | 206 | H | 338 | 7.8 |
| 347.780000 | 36.7 | quasi-peak | 101 | H | 175 | 16.6 |
| 348.111000 | 28.9 | quasi-peak | 102 | H | 175 | 16.6 |

**Figure 5: RE at 3 m from 1 to 3 GHz (WCDMA, 1C, 16QAM, BOT)**




Note 1: The visible peak in the 1930 – 1990 MHz region is the TX carrier.
Note 2: The "green" plot denotes that the measurement was done in Average mode

**Figure 6: RE at 3 m from 3 to 10 GHz (WCDMA, 1C, 16QAM, BOT)**

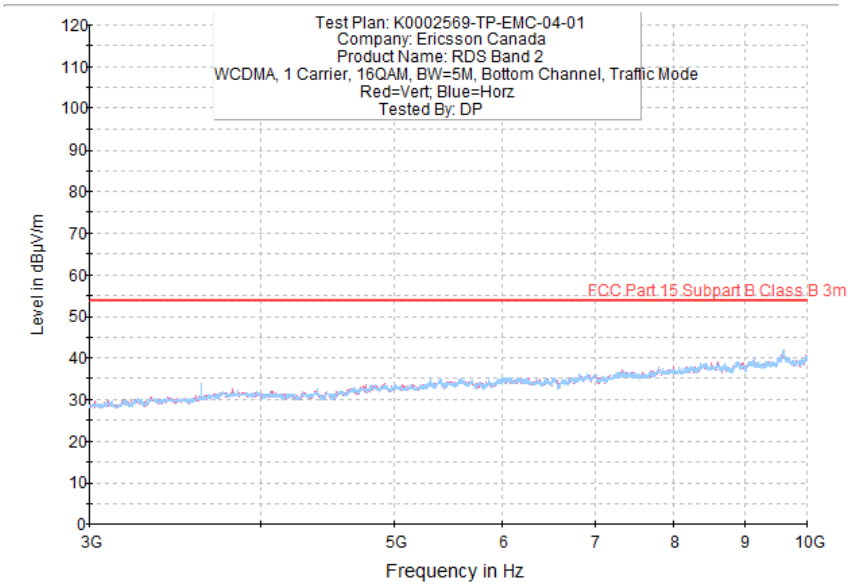


**Figure 7: RE at 3 m from 10 to 18 GHz (WCDMA, 1C, 16QAM, BOT)**

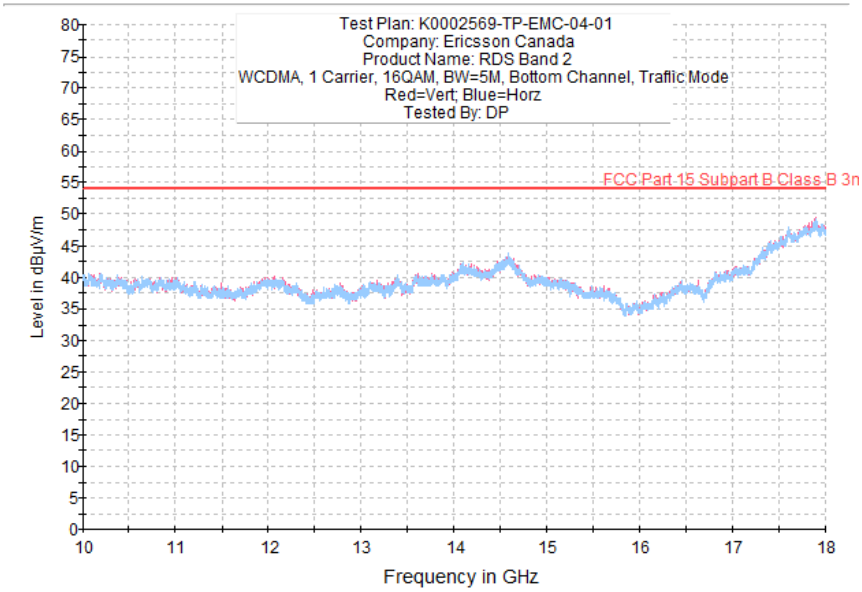
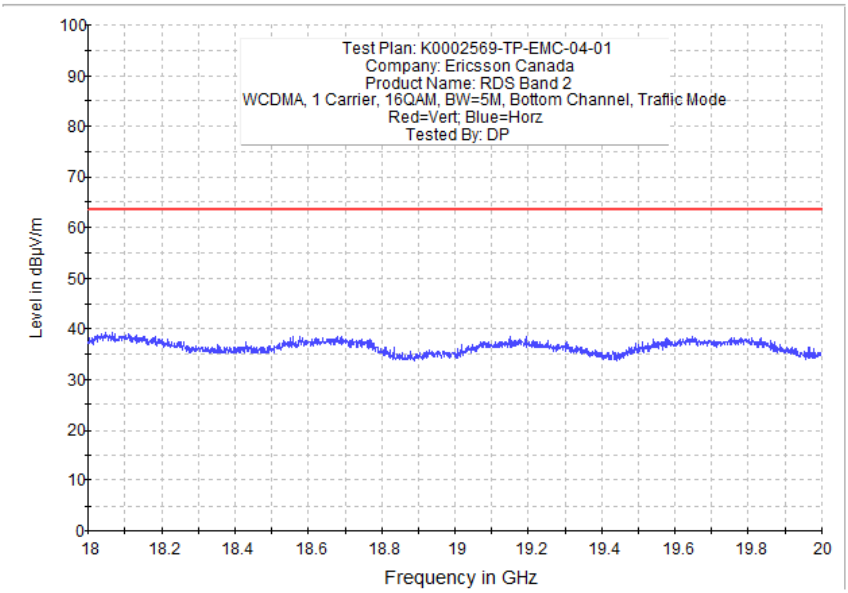



**Figure 8: RE at 1 m from 18 to 20 GHz (WCDMA, 1C, 16QAM, BOT)**



### 3.4.2 WCDMA, Single Carrier, 16 QAM, Middle

**Figure 9: RE at 3 m from 30 MHz to 1 GHz (WCDMA, 1C, 16QAM, Middle)**

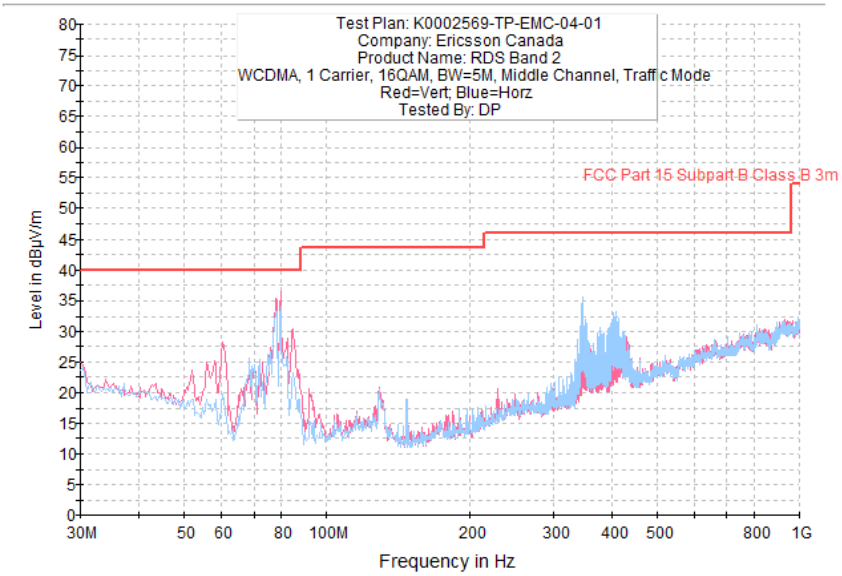
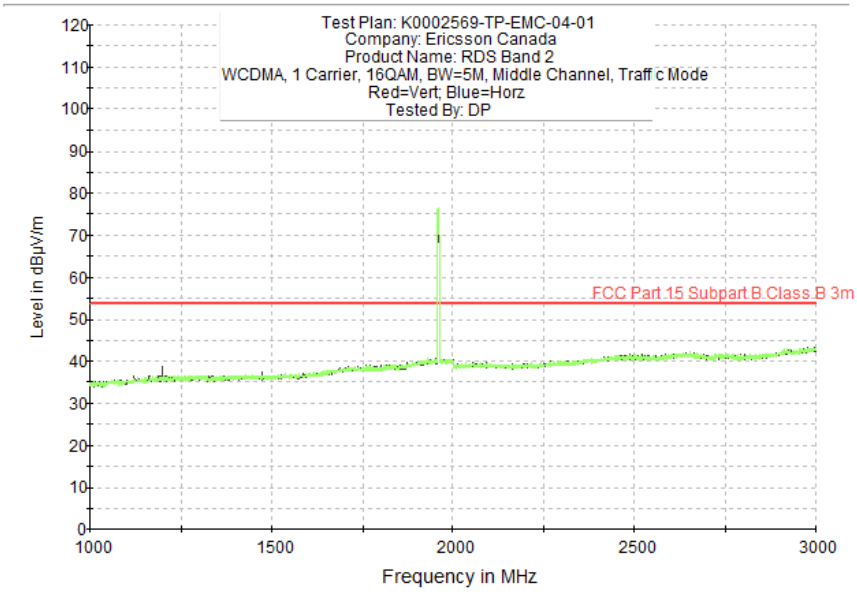



**Table 6: E-field RE test results (30 to 1000 MHz) (WCDMA, 1C, 16QAM, Middle)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 77.759250 | 34.7 | quasi-peak | 248 | V | 292 | 7.9 |
| 79.251750 | 26.7 | quasi-peak | 248 | V | 296 | 8.1 |
| 349.288000 | 29.8 | quasi-peak | 276 | H | 178 | 16.9 |

**Figure 10: RE at 3 m from 1 to 3 GHz (WCDMA, 1C, 16QAM, Middle)**




Note 1 : The visible peak in the 1930 – 1990 MHz region is the TX carrier.
Note 2: The “green” plot denotes that the measurement was done in Average mode

**Figure 11: RE at 3 m from 3 to 10 GHz (WCDMA, 1C, 16QAM, Middle)**

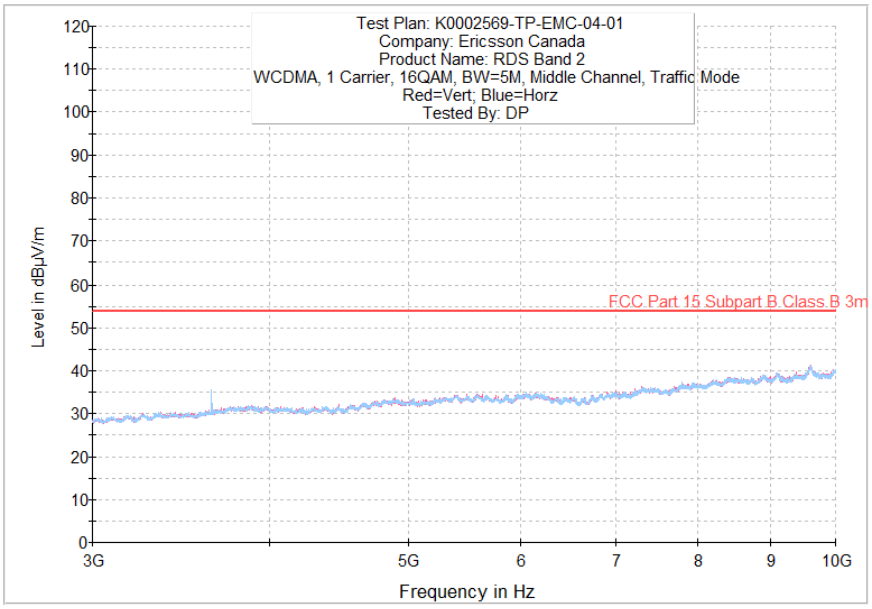


**Figure 12: RE at 3 m from 10 to 18 GHz (WCDMA, 1C, 16QAM, Middle)**

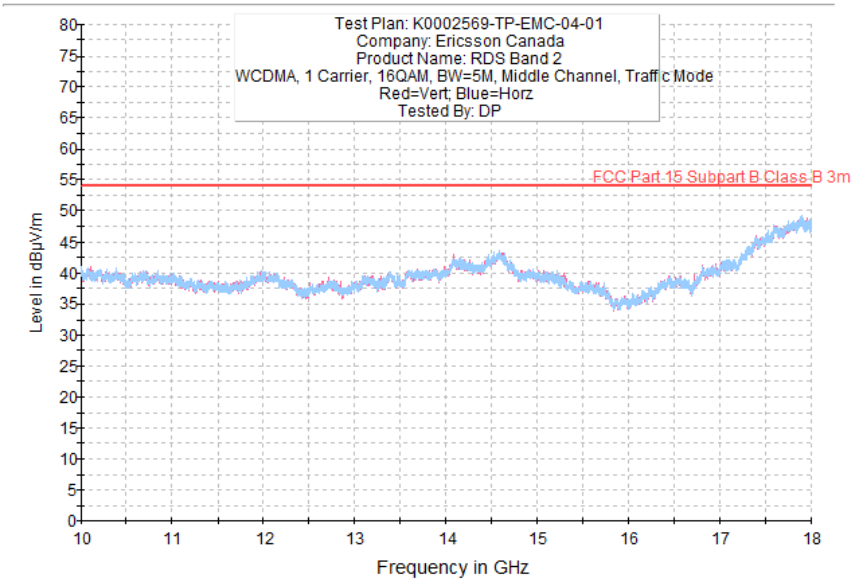
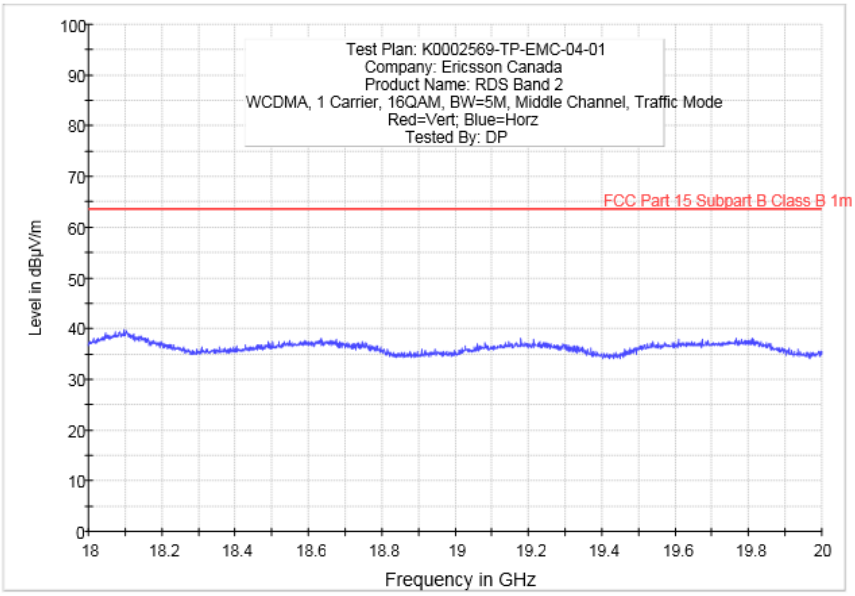



**Figure 13: RE at 1 m from 18 to 20 GHz (WCDMA, 1C, 16QAM, Middle)**



### 3.4.3 WCDMA, Single Carrier, 16 QAM, Top

**Figure 14: RE at 3 m from 30 MHz to 1 GHz (WCDMA, 1C, 16QAM, Top)**

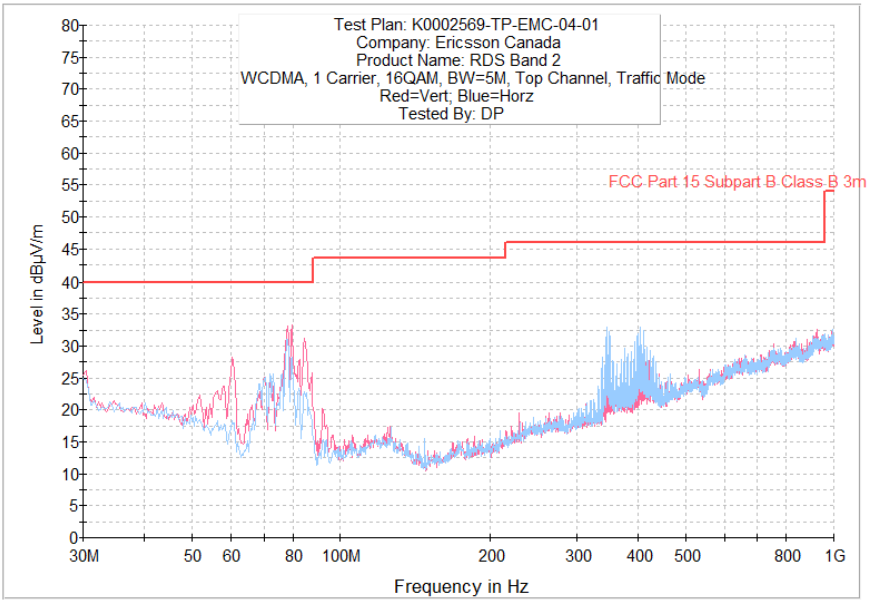
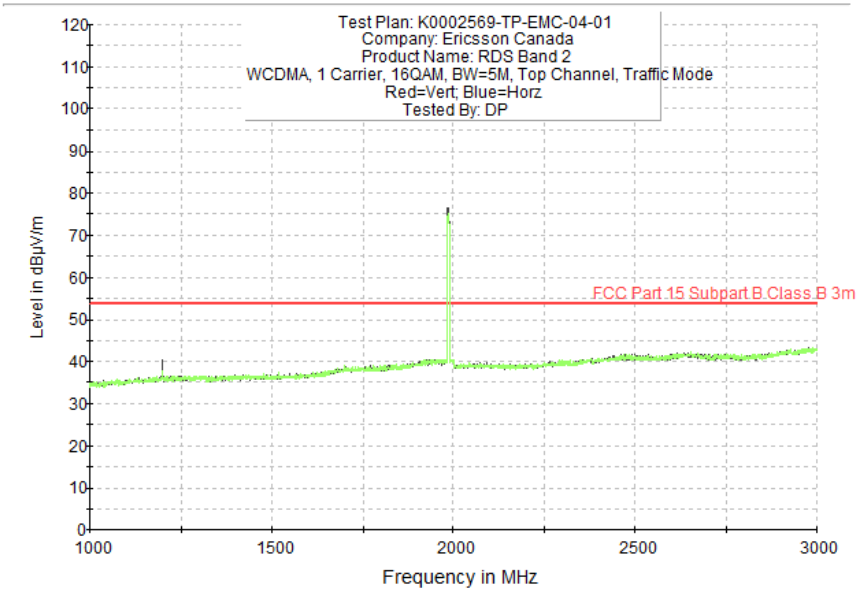



**Table 7: E-field RE test results (30 to 1000 MHz)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 77.759250 | 7.5 | quasi-peak | 139 | V | 288 | 7.9 |
| 80.048250 | 32.2 | quasi-peak | 181 | V | 278 | 8.1 |
| 84.872250 | 29.8 | quasi-peak | 248 | V | 248 | 9.1 |

**Figure 15: RE at 3 m from 1 to 3 GHz (WCDMA, 1C, 16QAM, Top)**




Note 1: The visible peak in the 1930 – 1990 MHz region is the TX carrier.
Note 2: The "green" plot denotes that the measurement was done in Average mode

**Figure 16: RE at 3 m from 3 to 10 GHz (WCDMA, 1C, 16QAM, Top)**

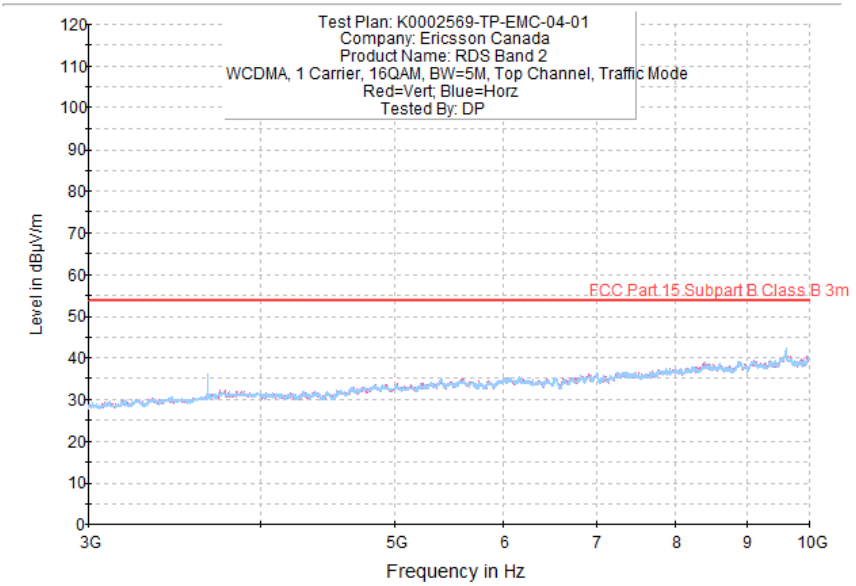


**Figure 17: RE at 3 m from 10 to 18 GHz (WCDMA, 1C, 16QAM, Top)**

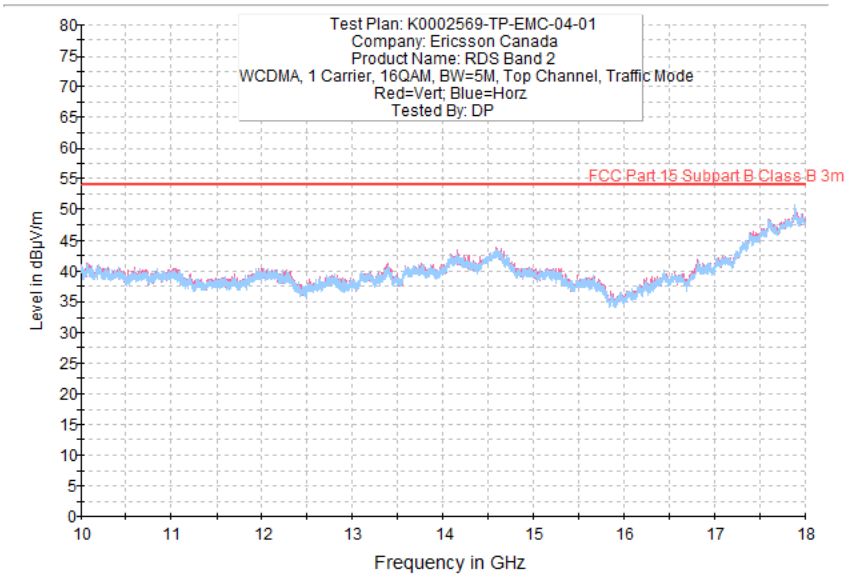
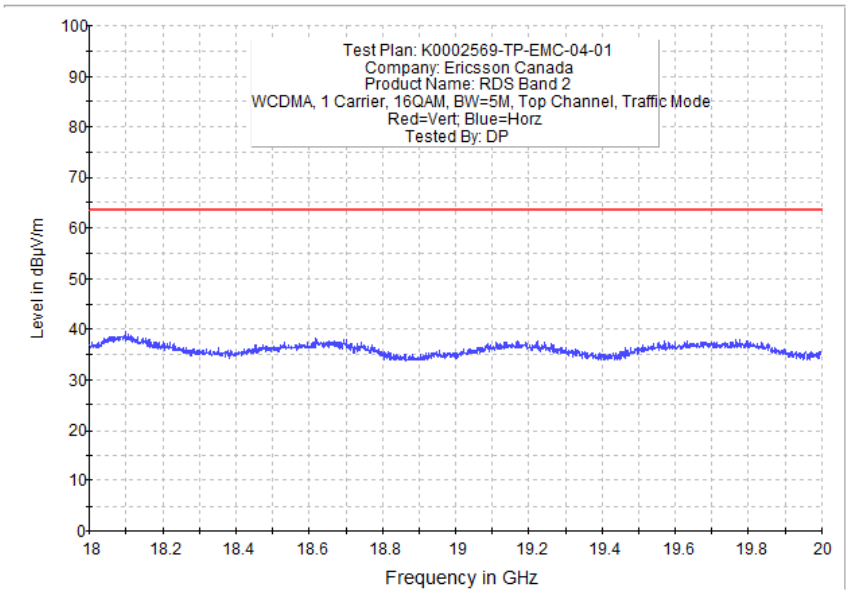



**Figure 18: RE at 1 m from 18 to 20 GHz (WCDMA, 1C, 16QAM, Top)**



### 3.4.4 WCDMA, 4 Carrier, 16 QAM, 5 MHz - Middle

**Figure 19: RE at 3 m from 30 MHz to 1 GHz (WCDMA, 4C, 16QAM, Middle)**

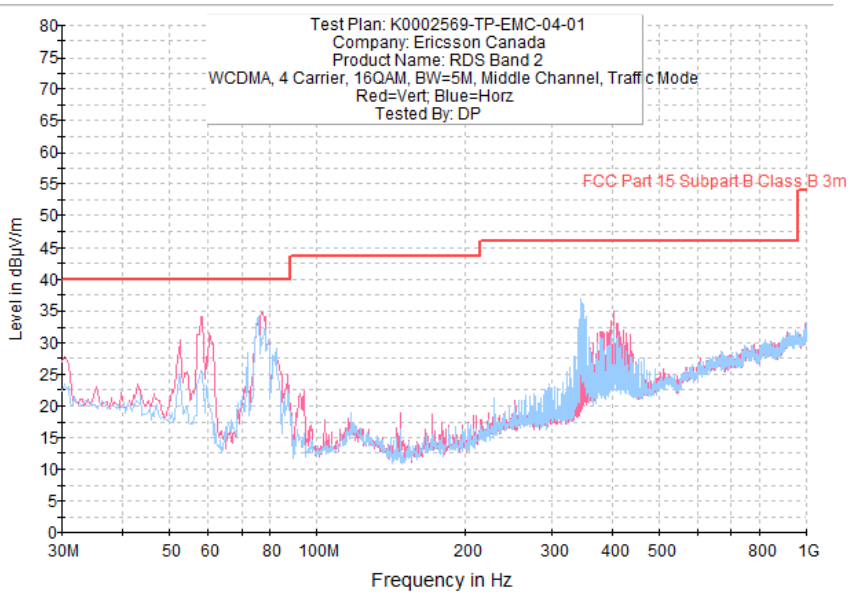
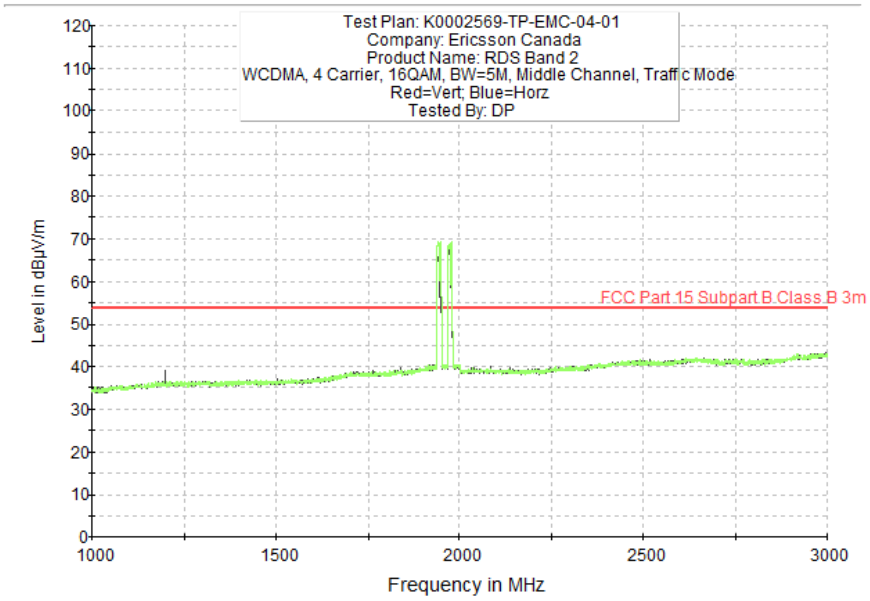



**Table 8: E-field RE test results (30 to 1000 MHz) (WCDMA, 4C, 16QAM, Middle)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 58.038750 | 11.7 | quasi-peak | 317 | V | 97 | 12.9 |
| 60.450750 | 9.6 | quasi-peak | 306 | V | 65 | 11.8 |
| 75.525750 | 5.6 | quasi-peak | 306 | H | 9 | 7.8 |
| 76.863750 | 27.7 | quasi-peak | 301 | V | 263 | 7.8 |
| 347.917000 | 16.5 | quasi-peak | 306 | H | 193 | 16.7 |

**Figure 20: RE at 3 m from 1 to 3 GHz (WCDMA, 4C, 16QAM, Middle)**




Note 1: The visible peaks in the 1930 – 1990 MHz region are the TX carriers.
Note 2: The "green" plot denotes that the measurement was done in Average mode

**Figure 21: RE at 3 m from 3 to 10 GHz (WCDMA, 4C, 16QAM, Middle)**

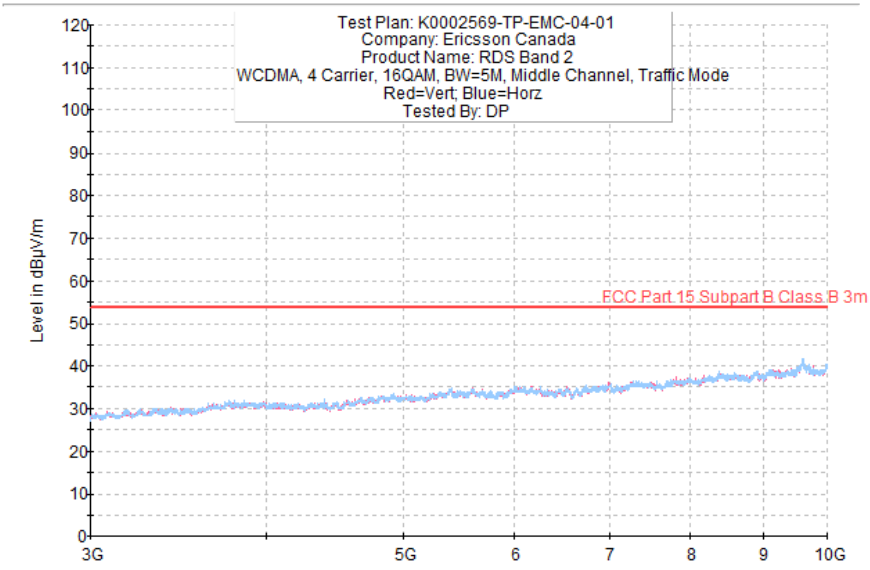


**Figure 22: RE at 3 m from 10 to 18 GHz (WCDMA, 4C, 16QAM, Middle)**

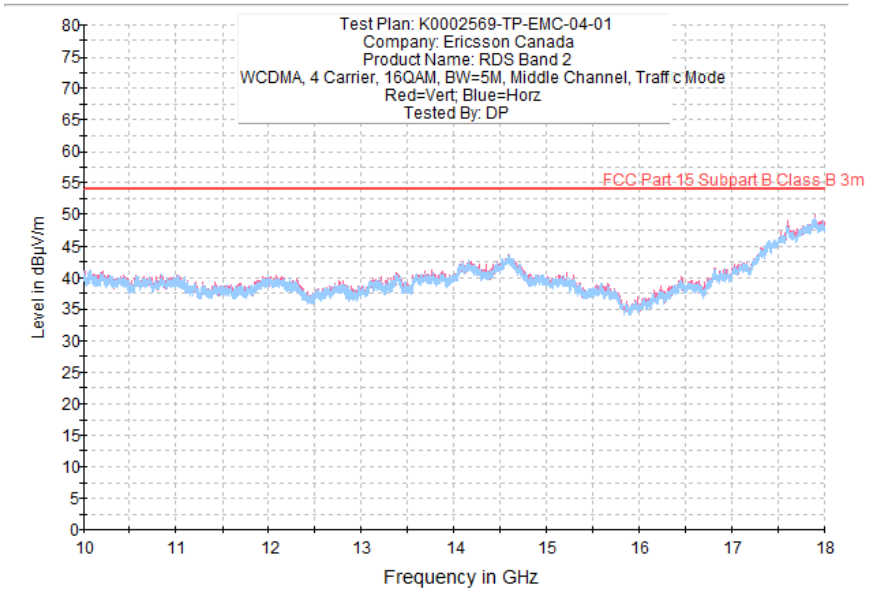
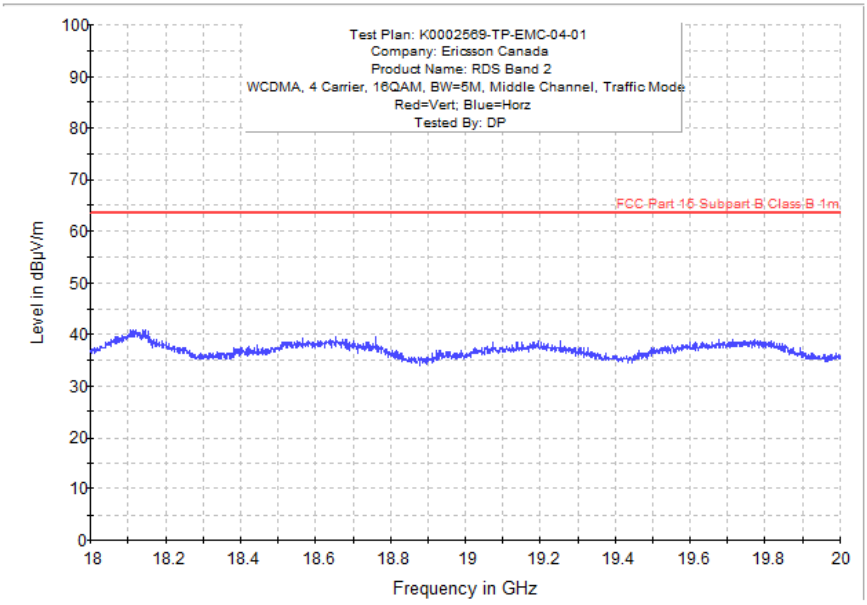



**Figure 23: RE at 1 m from 18 to 20 GHz (WCDMA, 4C, 16QAM, Middle)**



### 3.4.5 LTE, Single Carrier, QPSK, 5MHz, Middle

**Figure 24: RE at 3 m from 30 MHz to 1 GHz (LTE, 1C, QPSK, Middle)**

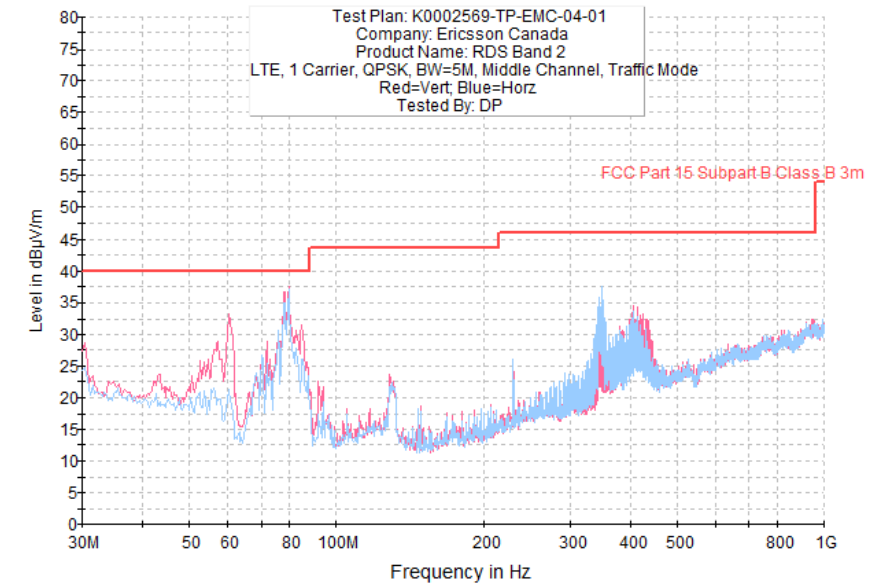
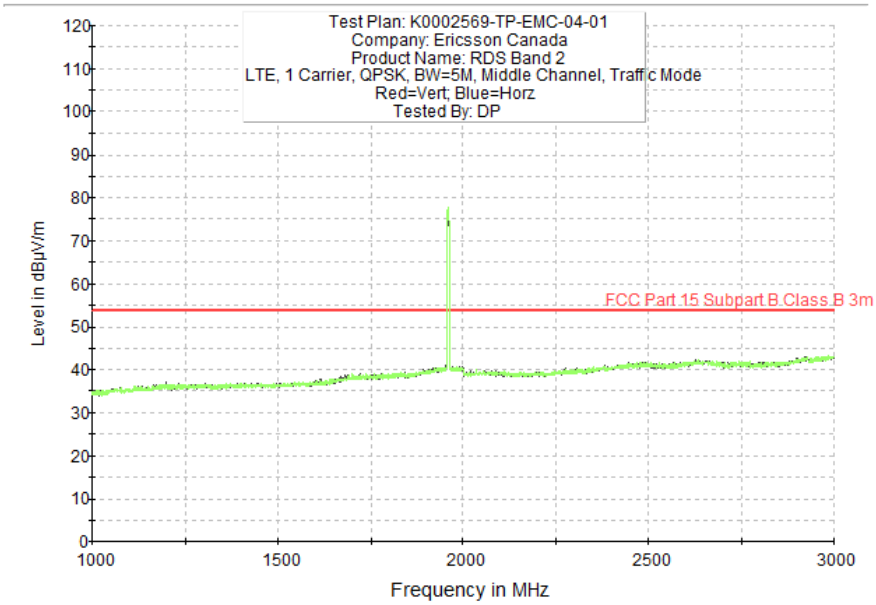



**Table 9: E-field RE test results (30 to 1000 MHz) (LTE, 1C, QPSK, Middle)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 59.849250 | 26.1 | quasi-peak | 264 | V | 109 | 12.0 |
| 78.057750 | 32.8 | quasi-peak | 251 | V | 292 | 7.9 |
| 79.251750 | 10.5 | quasi-peak | 251 | V | 289 | 8.1 |
| 347.305000 | 29.5 | quasi-peak | 262 | H | 175 | 16.7 |

**Figure 25: RE at 3 m from 1 to 3 GHz (LTE, 1C, QPSK, Middle)**




Note 1: The visible peak in the 1930 – 1990 MHz region is the TX carrier.
Note 2: The "green" plot denotes that the measurement was done in Average mode

**Figure 26: RE at 3 m from 3 to 10 GHz (LTE, 1C, QPSK, Middle)**

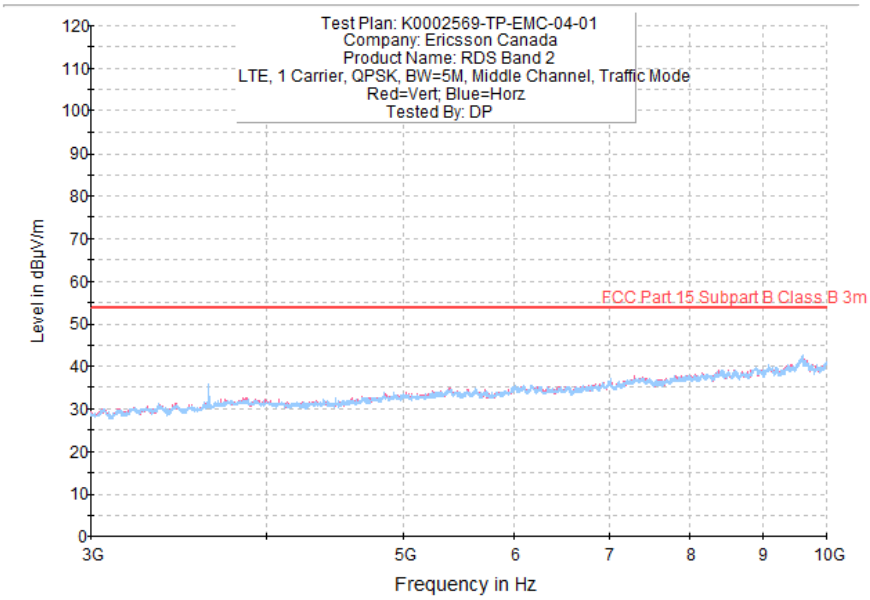


**Figure 27: RE at 3 m from 10 to 18 GHz (LTE, 1C, QPSK, Middle)**

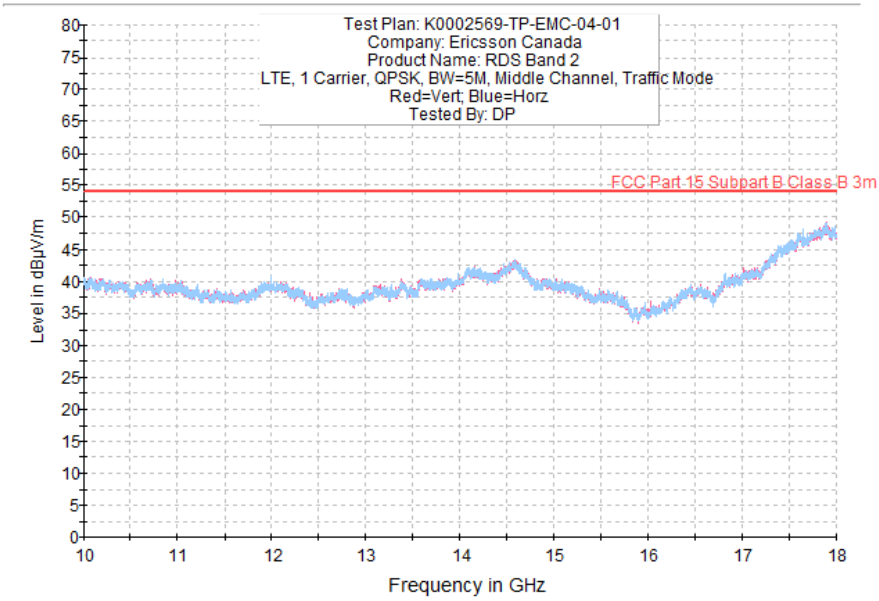
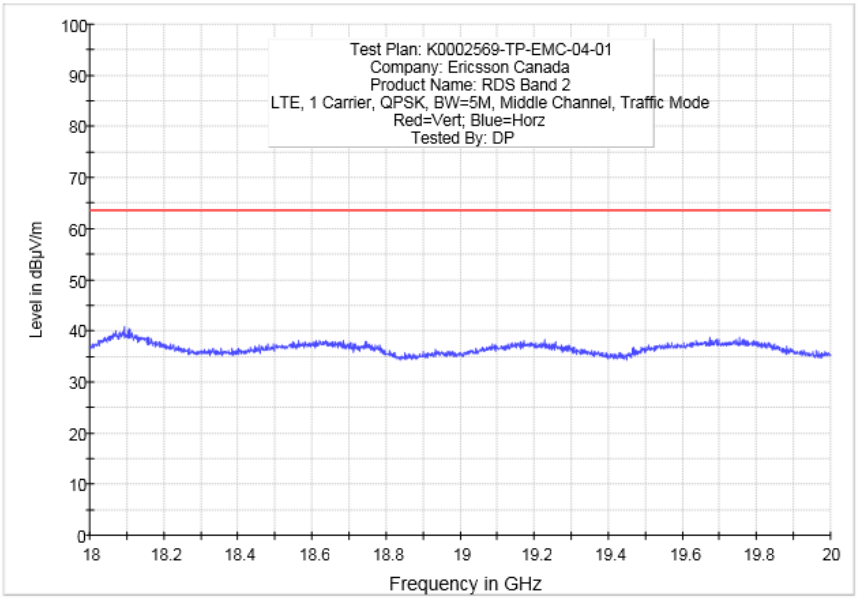



**Figure 28: RE at 1 m from 18 to 20 GHz (LTE, 1C, QPSK, Middle)**



### 3.4.6 Multi RAT, 2 LTE (QPSK) + 4 WCDMA (16 QAM), 5 MHz –Middle

**Figure 29: RE at 10 m from 10 kHz to 30 MHz (Multi RAT, Middle)**

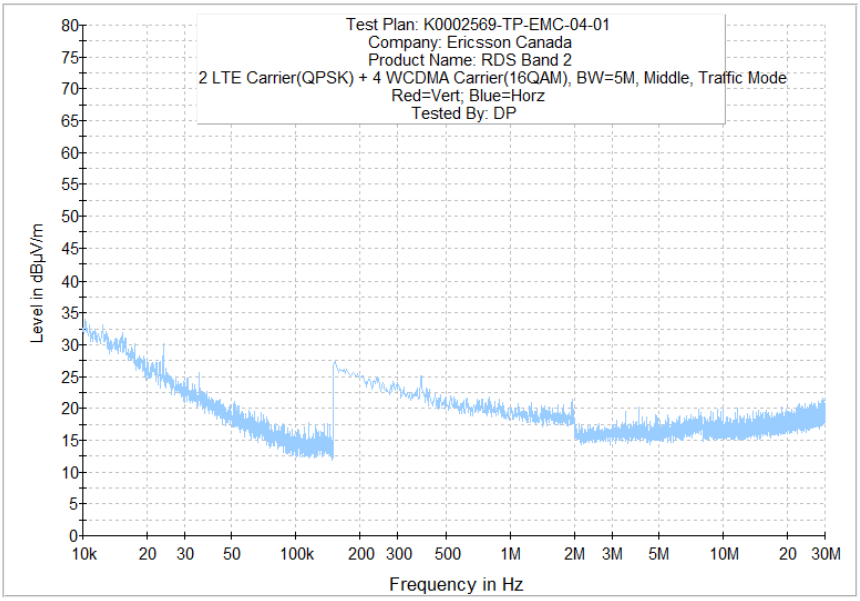



**Figure 30: RE at 3 m from 30 MHz to 1 GHz (Multi RAT, Middle)**

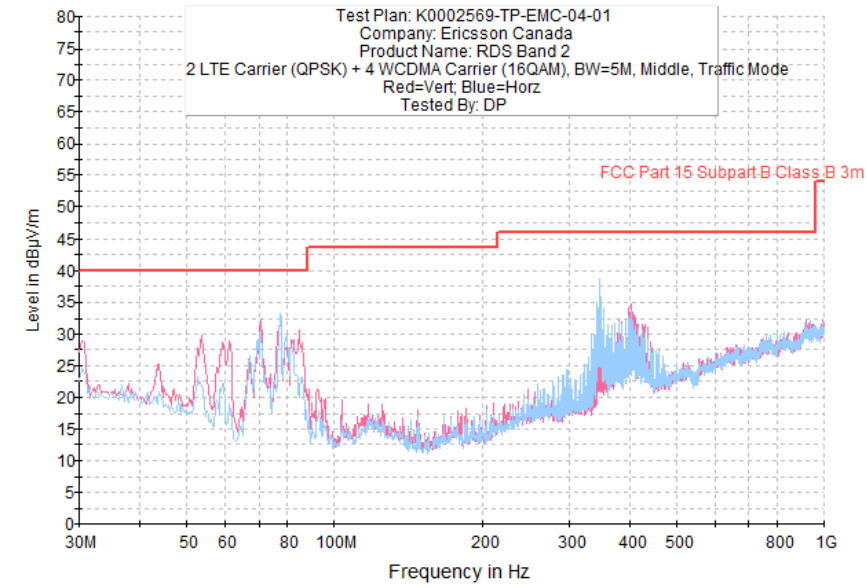
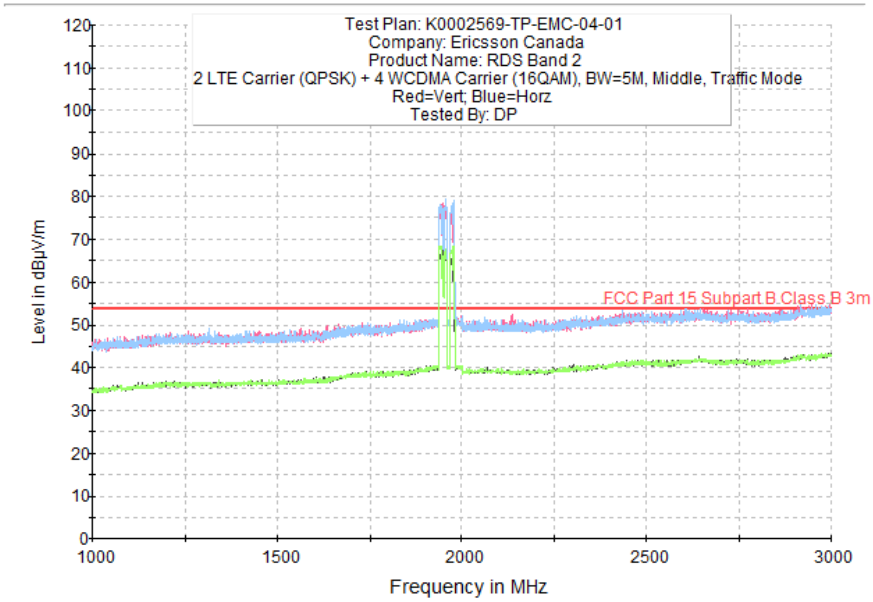


**Table 10: E-field RE test results (30 to 1000 MHz) (Multi RAT, Middle)**

| Frequency (MHz) | Level dB(µV/m) | Detector | Height (cm) | Polarization | Azimuth (degrees) | Correction (dB) |
|---|---|---|---|---|---|---|
| 71.003250 | 28.0 | quasi-peak | 102 | V | 264 | 8.3 |
| 77.636250 | 29.5 | quasi-peak | 203 | H | 338 | 7.8 |
| 84.326250 | 27.5 | quasi-peak | 217 | V | 275 | 9.0 |
| 348.111000 | 27.4 | quasi-peak | 103 | H | 181 | 16.6 |

**Figure 31: RE at 3 m from 1 to 3 GHz (Multi RAT, Middle)**




Note 1: The visible peaks in the 1930 – 1990 MHz region are the TX carriers.
Note 2: The “green” plot denotes that the measurement was done in Average mode

**Figure 32: RE at 3 m from 3 to 10 GHz (Multi RAT, Middle)**

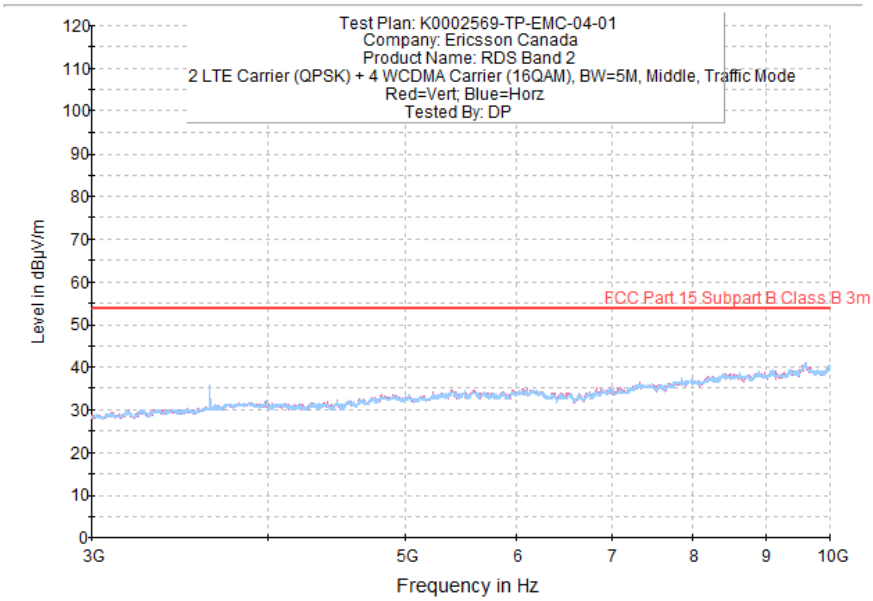



**Figure 33: RE at 3 m from 10 to 18 GHz (Multi RAT, Middle)**

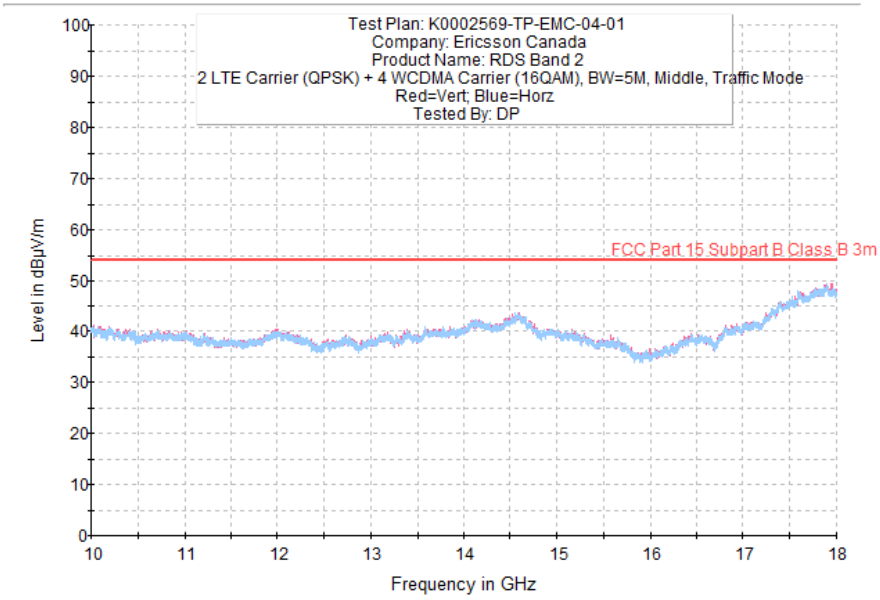
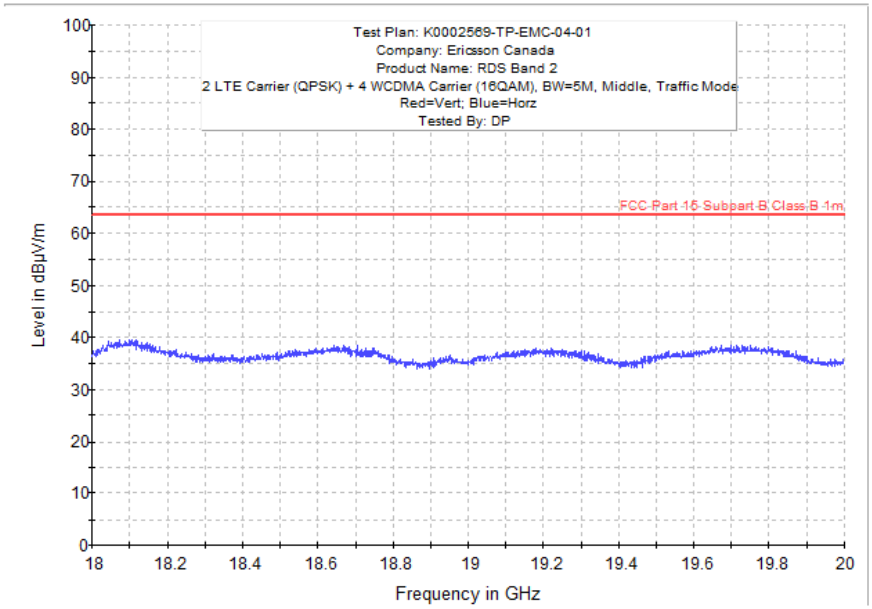


**Figure 34: RE at 1 m from 18 to 20 GHz (Multi RAT, Middle)**



## 3.5 Test Equipment

The equipment used for E-field RE testing was as follows.

**Table 11: Test equipment used for E-field RE**

| Description | Make | Model number | Asset ID | Calibration date | Calibration due |
|---|---|---|---|---|---|
| EMC Automation Software | Rohde & Schwarz | EMC32 V.8.52 | SSG013731 | not required | not required |
| Attenuator, 6 dB | Narda | 774-6 | SSG013706 | 2015-06-16 | 2016-06-15 |
| Coaxial Cable # 14 | Huber & Suhner | 104PEA, Sucoflex | SSG012041 | 2015-01-07 | 2016-01-07 |
| Coaxial Cable # 6 | Huber & Suhner | 106A, Sucoflex | SSG012456 | 2015-01-06 | 2016-01-06 |
| Bilog Antenna | Antenna Research Associates | LPB 2520A | SSG012772 | 2015-01-14 | 2016-01-14 |
| EMI Receiver | Rohde & Schwarz | ESU26 | SSG013729 | 2015-01-30 | 2016-01-30 |
| Coaxial Cable # 26 | Huber & Suhner | ST18/Nm/Nm/36, Sucotest | SSG012785 | 2015-01-09 | 2016-01-09 |
| Coaxial Cable # 27 | Huber & Suhner | ST18/Nm/Nm/36, Sucotest | SSG012786 | 2015-01-07 | 2016-01-07 |
| Pre-Amplifier | BNR | LNA | SSG012594 | 2015-03-30 | 2016-03-30 |
| Double Ridged Horn | Emco | 3115 | SSG012508 | 2015-01-12 | 2016-01-12 |
| Coaxial Cable | Micro-Coax | UFA 210B-1-1500-504504, Utiflex | SSG012376 | 2015-01-09 | 2016-01-09 |
| EMI Receiver | Rohde & Schwarz | ESU40 | SSG013672 | 2014-11-11 | 2015-11-11 |
| Coaxial Cable | Huber & Suhner | 101 PEA, Sucoflex | SSG012290 | 2014-08-11 | 2015-08-11 |
| Horn Antenna (18 - 26.5 GHz) | Emco | 3160-09 | SSG012292 | 2014-12-31 | 2015-12-31 |
| Active Monopole Antenna | Emco | 3301B | SSG012083 | 2015-02-02 | 2016-02-02 |
| Coaxial Cable # 3 | Huber & Suhner | 106A, Sucoflex | SSG012455 | 2015-01-06 | 2016-01-06 |

## 3.6 Test Conclusion

The RD 2242 B2 has passed the requirements of FCC part 2.1053, 2.1057, FCC Part 24.238 and RSS-133 Section 6.5.

More detailed conducted measurements of the frequency bands immediately outside and adjacent to the equipment's operating frequency block can be found in TUV report "RD 2242 B2" Report reference: 75930604.

All test results were gathered in field strengths measurements (dBuV/m). A table of theoretical correspondence between field strengths and power is presented in Section 5.2 Appendix B. Using this table to convert field strengths into corresponding power levels shows that all measured emissions had greater to 20 dB of passing margin to power limits of the referenced standards. As indicated in FCC Part 2 "*The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported"*. No substitution measurement results are included in this report.

# 4. References

The documents, regulations, and standards that are referenced throughout this test report are listed alphabetically as follows.

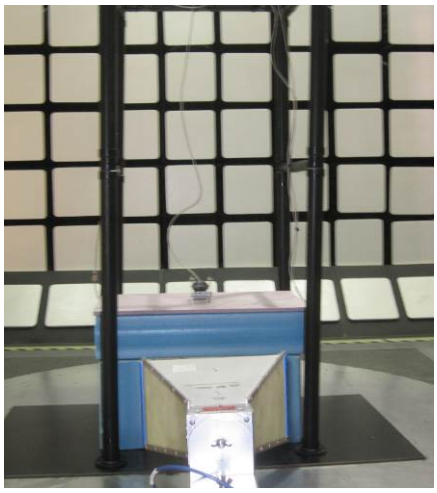
1. ANSI C63.2-2009, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
2. ANSI C63.4-2003, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
3. ANSI/TIA-603-C-2004, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
4. APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (http://www.aplac.org)
5. CISPR 16 Publications (all parts and sections), Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus.
6. RSS-133 — 2 GHz Personal Communications Services, Issue 6, January 2013.
7. RSS Gen — General Requirements and Information for the Certification of Radio Apparatus, Issue 4, November 13, 2014.
8. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, U.S. Federal Communications Commission.
9. ICES-003 Issue 5 (2012), “Spectrum Management: Interference-causing equipment standard (Digital Apparatus)”. DVC Lab Operations Manual KG000347-QD-LAB-01.
10. DVC Quality Manual, K0000608-QD-QM-01.
11. EMC General Lab Test Procedure, KP000270-LP-EMC-01.
12. ILAC, International Laboratory Accreditation Cooperation, Website (http://www.ilac.org/)
13. Lab34 Edition 1, “The Expression of Uncertainty in EMC Testing”, UKAS, August 2002.
14. Standards Council of Canada, Scope of Accreditation for the Design Validation Centre of Flextronics Canada Design Services Inc. outlined at the following web site http://palcan.scc.ca/Specs/PDF/95_e.pdf

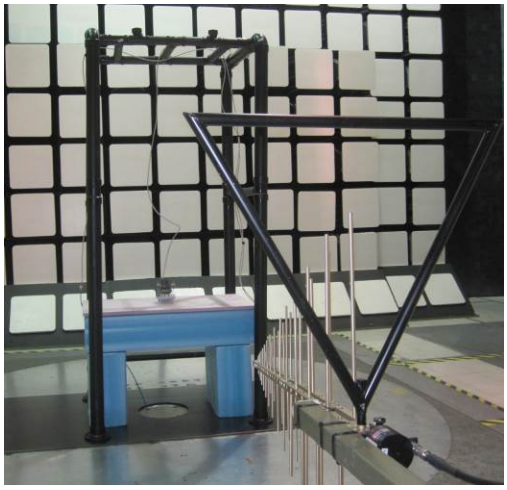
# 5. Appendices

## 5.1 Appendix A: Test setup photographs

**Figure 35: Setup for radiated emission tests**

**Figure 36: Photos of receive antennae**





## 5.2 Appendix B: ITU-R SM.329-12 Annex 1 Table 7

The following table provides the theoretical correspondence between field strengths and power and is useful in determining margin based on field strength measurements.

**Figure 37: Correspondence between e.i.r.p., e.r.p., field strength, E, and pfd**

| e.i.r.p. (dBm) | e.i.r.p. (nW) | e.i.r.p. (dB(pW)) | e.i.r.p. (dBW) | e.r.p. (dBm) | *E* field free space (dB(μV/m)) at 10 m | $E_{max}$ OATS (dB(μV/m)) at 10 m | pfd free space (dB(W/m$^2$)) at 10 m | pfd maximum OATS (dB(W/m$^2$)) at 10 m |
|---|---|---|---|---|---|---|---|---|
| –90 | 0.001 | 0 | –120 | –92.15 | –5.2 | –1.2 | –151.0 | –147.0 |
| –80 | 0.01 | 10 | –110 | –82.15 | 4.8 | 8.8 | –141.0 | –137.0 |
| –70 | 0.1 | 20 | –100 | –72.15 | 14.8 | 18.8 | –131.0 | –127.0 |
| –60 | 1 | 30 | –90 | –62.15 | 24.8 | 28.8 | –121.0 | –117.0 |
| –50 | 10 | 40 | –80 | –52.15 | 34.8 | 38.8 | –111.0 | –107.0 |
| –40 | 100 | 50 | –70 | –42.15 | 44.8 | 48.8 | –101.0 | –97.0 |
| –30 | 1 000 | 60 | –60 | –32.15 | 54.8 | 58.8 | –91.0 | –87.0 |
| –20 | 10 000 | 70 | –50 | –22.15 | 64.8 | 68.8 | –81.0 | –77.0 |
| –10 | 100 000 | 80 | –40 | –12.15 | 74.8 | 78.8 | –71.0 | –67.0 |
| 0 | 1 000 000 | 90 | –30 | –2.15 | 84.8 | 88.8 | –61.0 | –57.0 |

## 5.3 Appendix C: Abbreviations

The abbreviations of terms used in this document are as follows.

| Term | Definition |
|---|---|
| AE | Auxiliary Equipment |
| AFC | Ambient Free Chamber |
| AVG | Average detector |
| CC | RF Current Clamp |
| CCC | Capacitive Coupling Clamp |
| CDN | Coupling-decoupling Network |
| dB | Decibel |
| DVC | Design Validation Centre (Flextronics) |
| EMC | Electromagnetic Compatibility |
| EMI | Electromagnetic Interference |
| EN | European Normative |
| ETSI | European Telecommunications Standards Institute |
| EUT | Equipment Under Test |
| GND | Ground |
| NA, na | not applicable |
| NAMAS | National Measurement Accreditation Service |
| PK | Peak Detector |
| QP | Quasi-peak Detector |
| RBW | Resolution Bandwidth |
| RE | Radiated Emissions |
| RF | Radio-Frequency |
| RMS | Root-mean-square |
| SA | Spectrum Analyzer |
| SCC | Standards Council of Canada |
| SG | RF Signal Generator |
| VBW | Video Bandwidth |

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## Radiated Emissions Report

## End of Document