

Figure 8.2-49: Conducted band edge emission at 2200 MHz, 15 MHz channel LTE + IoT operation (RBW = 1% of BW)

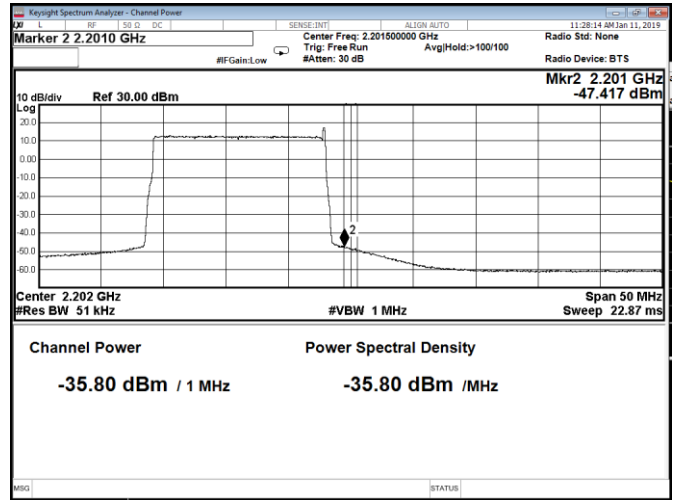


Figure 8.2-50: Conducted band edge emission at 2201 MHz, 15 MHz channel LTE + IoT operation (RBW = 1 MHz)

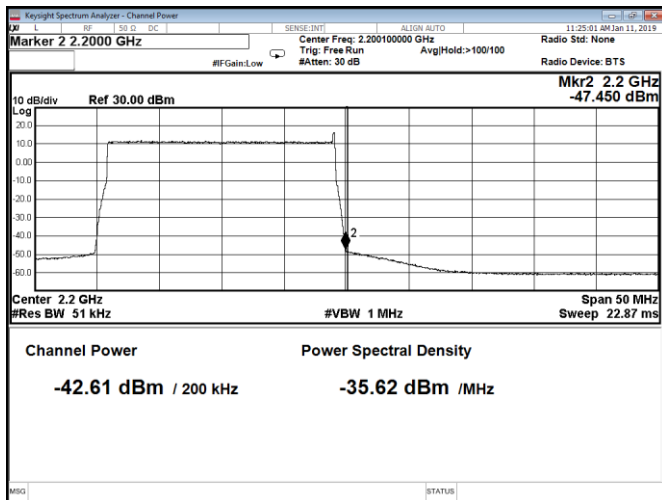


Figure 8.2-51: Conducted band edge emission at 2200 MHz, 20 MHz channel LTE + IoT operation (RBW = 1% of BW)

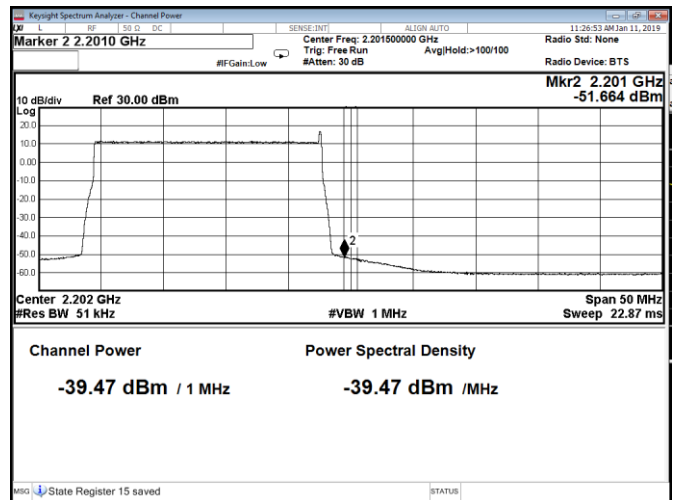


Figure 8.2-52: Conducted band edge emission at 2201 MHz, 20 MHz channel LTE + IoT operation (RBW = 1 MHz)

8.3 FCC 27.53 and RSS-139, 4.2, RSS-170, 5.4 Radiated spurious emissions

8.3.1 Definitions and limits

FCC:

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

RSS-139, Section 6.6:

i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

RSS-170, Section 5.4:

The transmitter unwanted emissions shall be measured for all channel bandwidths with the carrier frequency set at both the highest and lowest channels in which the equipment is designed to operate.

The e.i.r.p. density of unwanted and carrier-off state emissions outlined in this section (Section 5.4) shall be averaged over any 2-ms active transmission using an RMS detector with a resolution bandwidth of 1 MHz for broadband emissions and a resolution bandwidth of 1 kHz for discrete emissions, unless stated otherwise.

For ATC equipment operating in the bands 2000-2020 MHz and 2180-2200 MHz, the unwanted emission limits shall be determined using a measurement bandwidth of 1 MHz or greater. However, in the 1 MHz band immediately outside and adjacent to the equipment's operating frequency block, a resolution bandwidth of at least 1% of the occupied bandwidth may be employed.

5.4.1.2 ATC Base Station Equipment operating in bands 2000-2020 MHz and 2180-2200 MHz

he unwanted emissions of ATC base station equipment transmitting in the bands 2000-2020 MHz and 2180-2200 MHz shall comply with the following:

(1) The power of any unwanted emissions at frequencies outside the equipment's operating frequency block shall be attenuated below the transmitter power P (dBW), by $43 + 10 \log p$ (watts), dB.

(2) For equipment operating in the band 2180–2200 MHz, in addition to (1), the power of any emissions on all frequencies between 2200 MHz and 2290 MHz shall not exceed an e.i.r.p. of -100.6 dBW/4 kHz (-70.6 dBm/4 kHz).*

* This requirement is for implementation and is enforced at the time of licensing. Therefore results are not included in this report.

8.3.2 Test summary

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|---------------|---------------|
| Test date | July 18, 2018 |
| Test engineer | Predrag Golic |

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using a peak detector.
RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.
Testing was performed with RF ports terminated with 50 Ohm load.

8.3.4 Test data

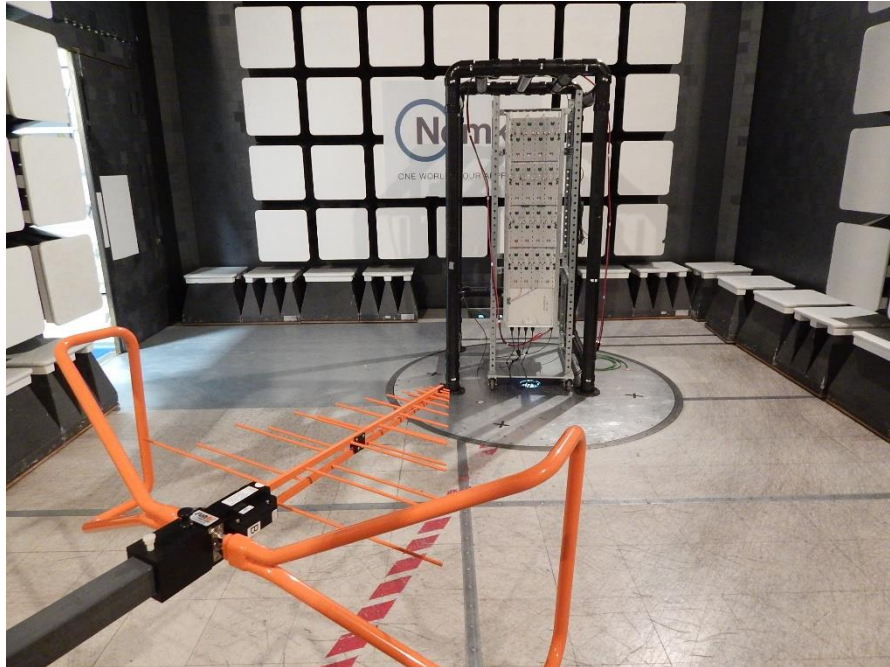


Figure 8.3-1: Radiated emissions setup photo – below 1 GHz

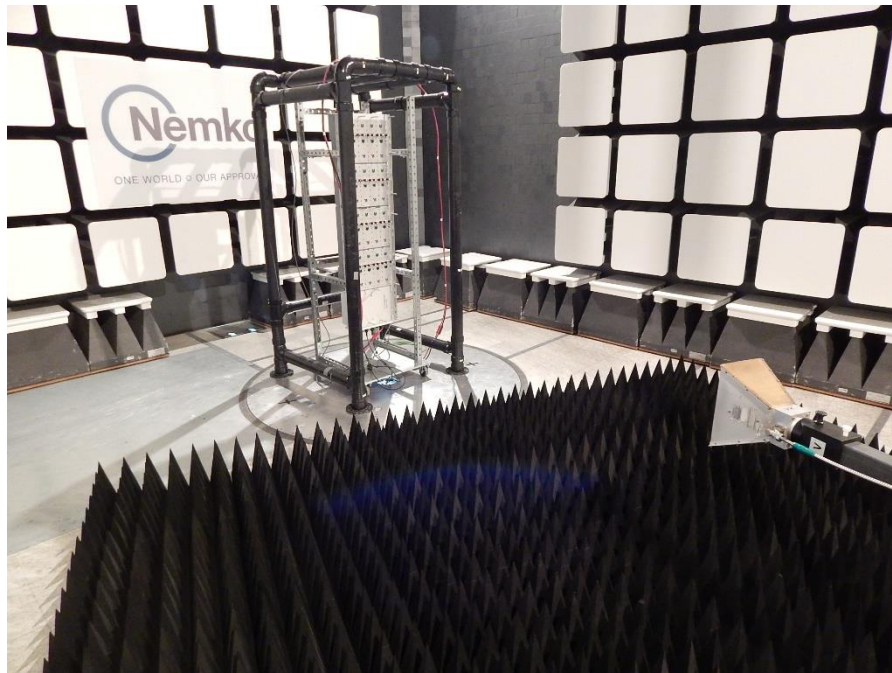


Figure 8.3-2: Radiated emissions setup photo – above 1 GHz

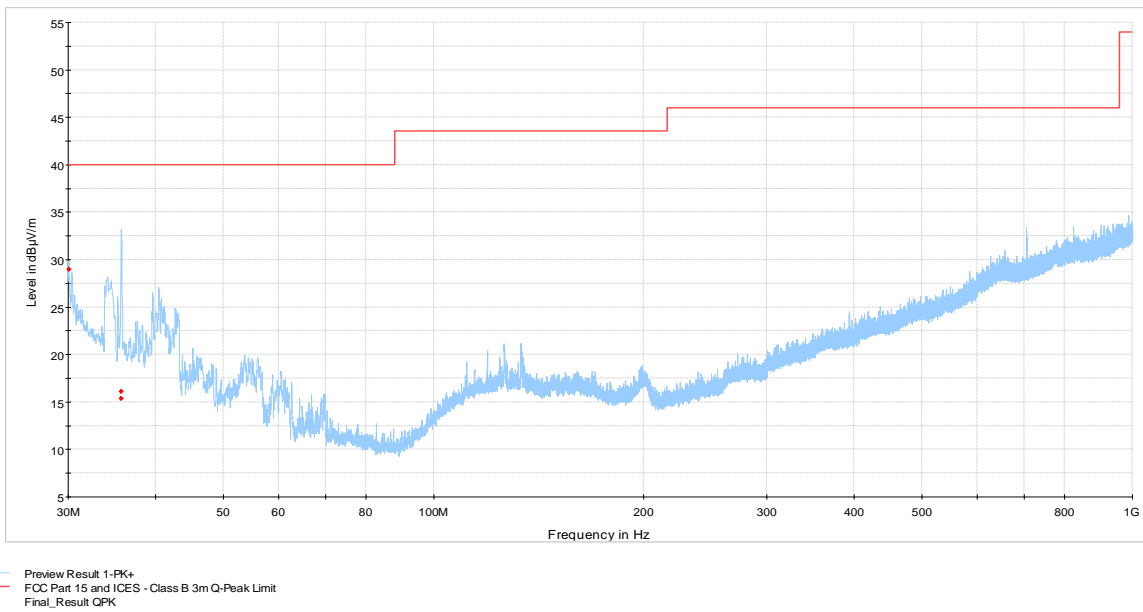
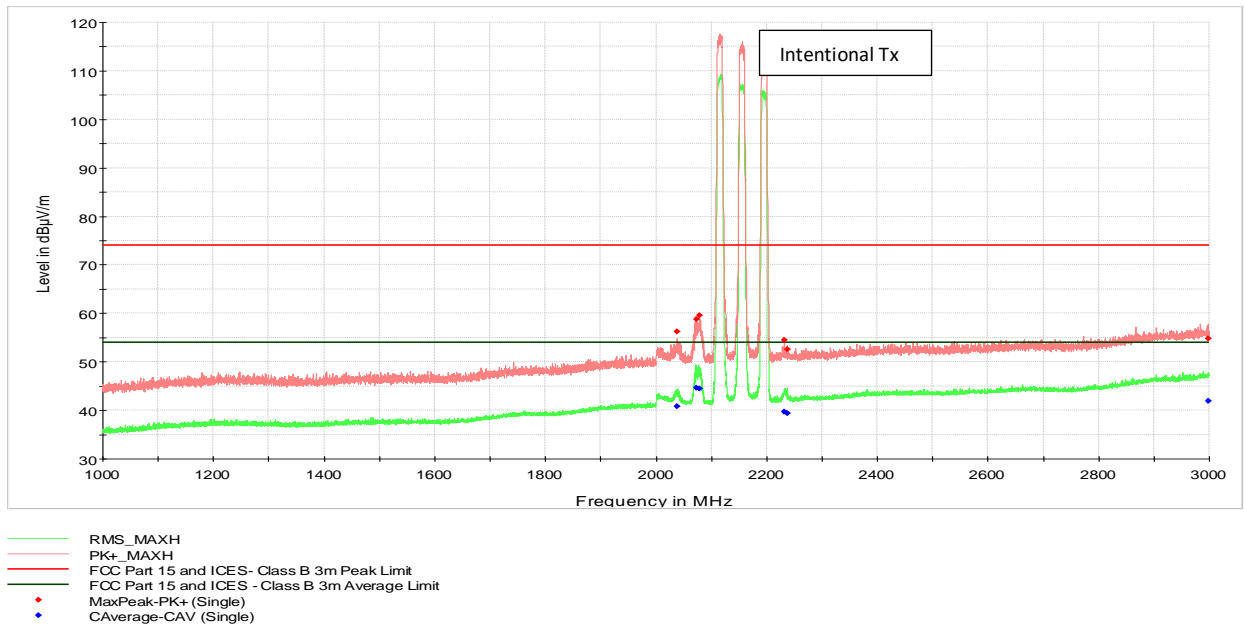
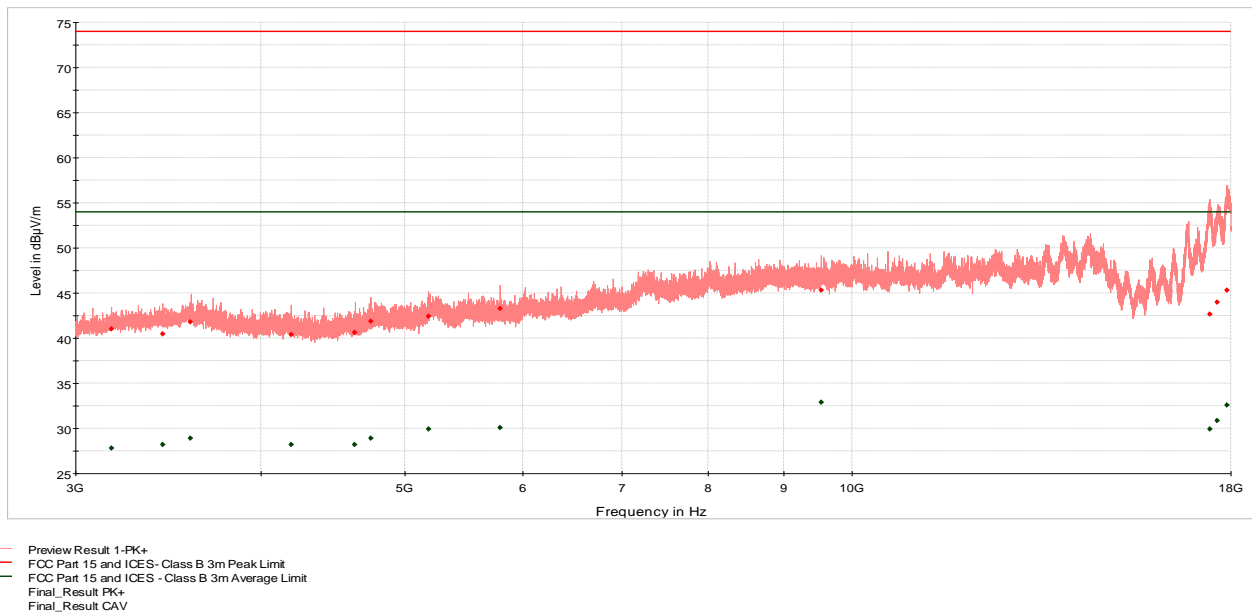


Figure 8.3-1: Radiated spurious emission below 1 GHz



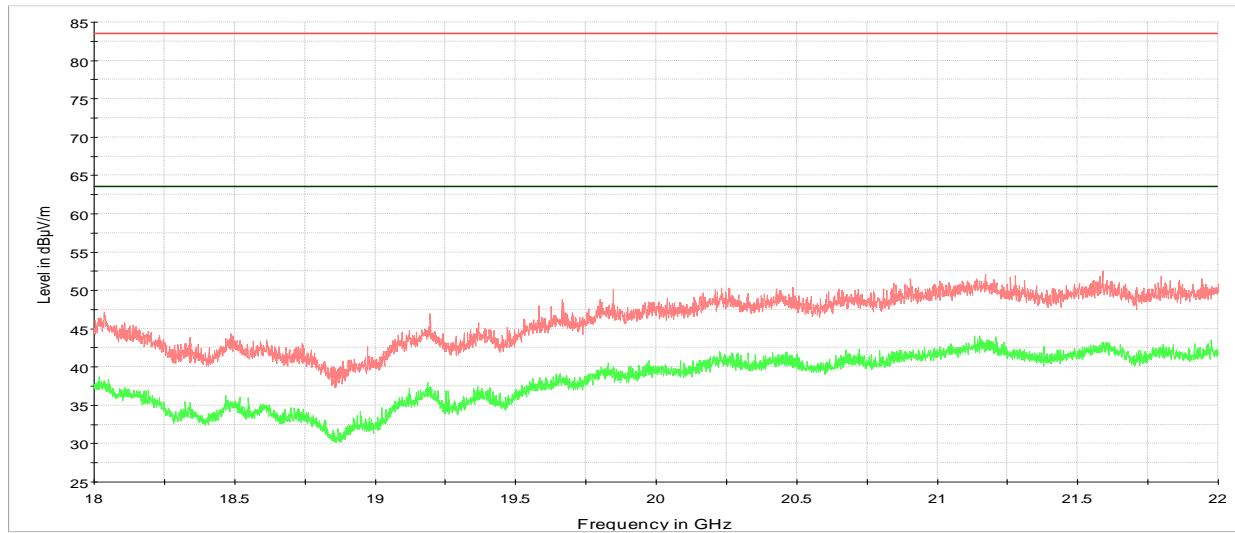
The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.3-2: Radiated spurious emission (1 to 3 GHz)



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 8.3-3: Radiated emissions spectral plot (3 to 18 GHz)



— AVG_MAXH
— PK+_MAXH
— FCC Part 15 and ICES - Class B 1m Peak Limit
— FCC Part 15 and ICES - Class B 1m Average Limit

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 8.3-4: Radiated emissions spectral plot (18 to 22 GHz)

8.4 FCC Part 2.1049 and RSS-Gen, 6.7 Occupied bandwidth

8.4.1 Definitions and limits

FCC:

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.

RSS-Gen, 6.7

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

8.4.2 Test summary

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|---------------|------------------|
| Test date | January 11, 2019 |
| Test engineer | Andrey Adelberg |

8.4.3 Observations, settings and special notes

Spectrum analyzer settings:

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|----------------------|--------------|
| Detector mode | Peak |
| Resolution bandwidth | ≥1 % of span |
| Video bandwidth | RBW × 3 |
| Trace mode | Max Hold |

8.4.4 Test data

Table 8.4-1: Occupied bandwidth results

| Remarks | Frequency, MHz | 99% OBW, MHz | 26 dB BW, MHz |
|-----------------------------|----------------|--------------|---------------|
| 5 MHz, 256QAM, low channel | 2112.5 | 4.4792 | 4.695 |
| 5 MHz, QPSK, mid channel | 2155.0 | 4.4711 | 4.698 |
| 5 MHz, QPSK, high channel | 2197.5 | 4.4829 | 4.722 |
| 10 MHz, 256QAM, low channel | 2115.0 | 9.4188 | 9.722 |
| 10 MHz, QPSK, mid channel | 2155.0 | 9.4206 | 9.727 |
| 10 MHz, QPSK, high channel | 2195.0 | 9.4313 | 9.704 |
| 15 MHz, 256QAM, low channel | 2117.5 | 13.981 | 14.40 |
| 15 MHz, QPSK, mid channel | 2155.0 | 13.997 | 14.39 |
| 15 MHz, QPSK, high channel | 2192.5 | 13.995 | 14.40 |
| 20 MHz, 256QAM, low channel | 2120.0 | 18.465 | 19.01 |
| 20 MHz, QPSK, mid channel | 2155.0 | 18.478 | 19.05 |
| 20 MHz, QPSK, high channel | 2190.0 | 18.463 | 19.05 |

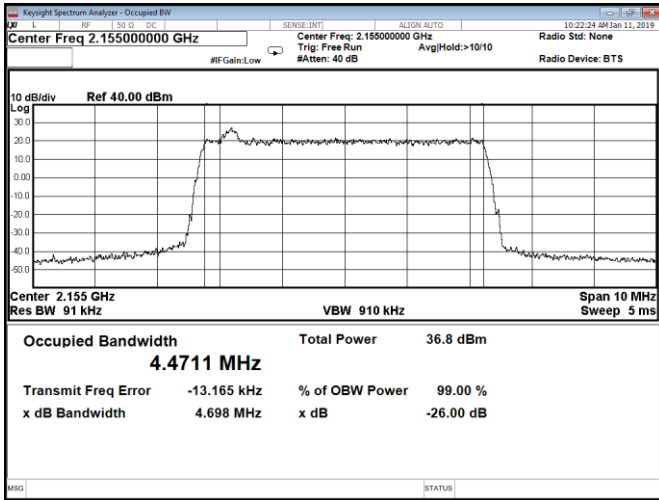


Figure 8.4-1: Occupied bandwidth for LTE + IoT, 5 MHz channel, sample plot

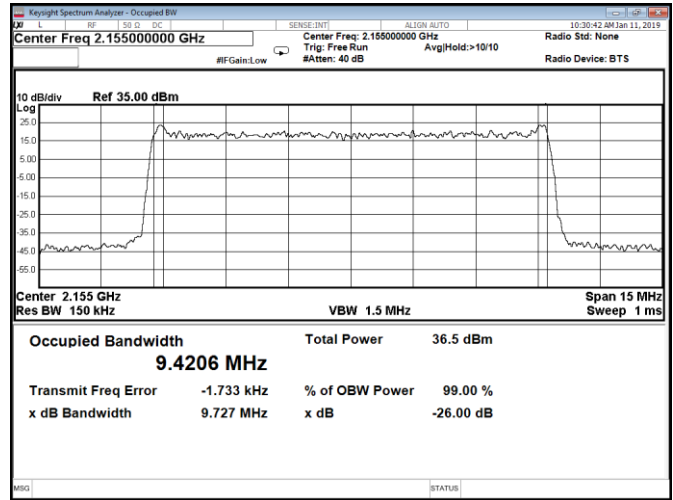


Figure 8.4-2: Occupied bandwidth for LTE + IoT, 10 MHz channel, sample plot

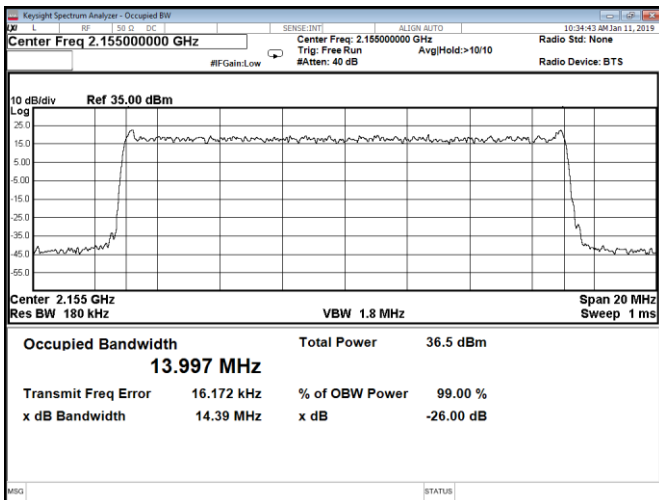


Figure 8.4-3: Occupied bandwidth for LTE + IoT, 15 MHz channel, sample plot

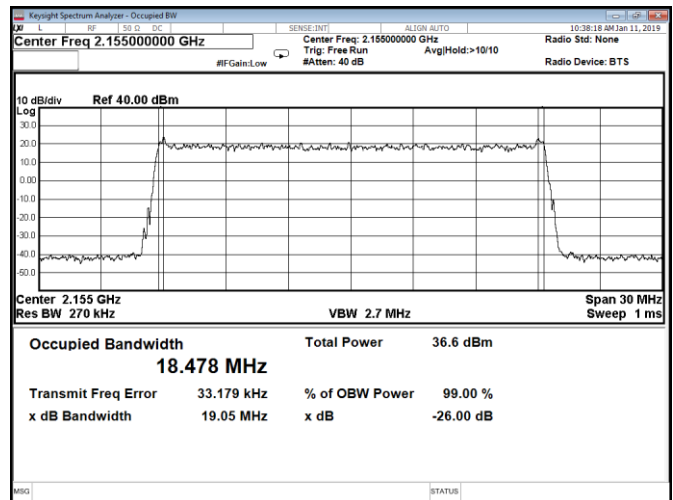
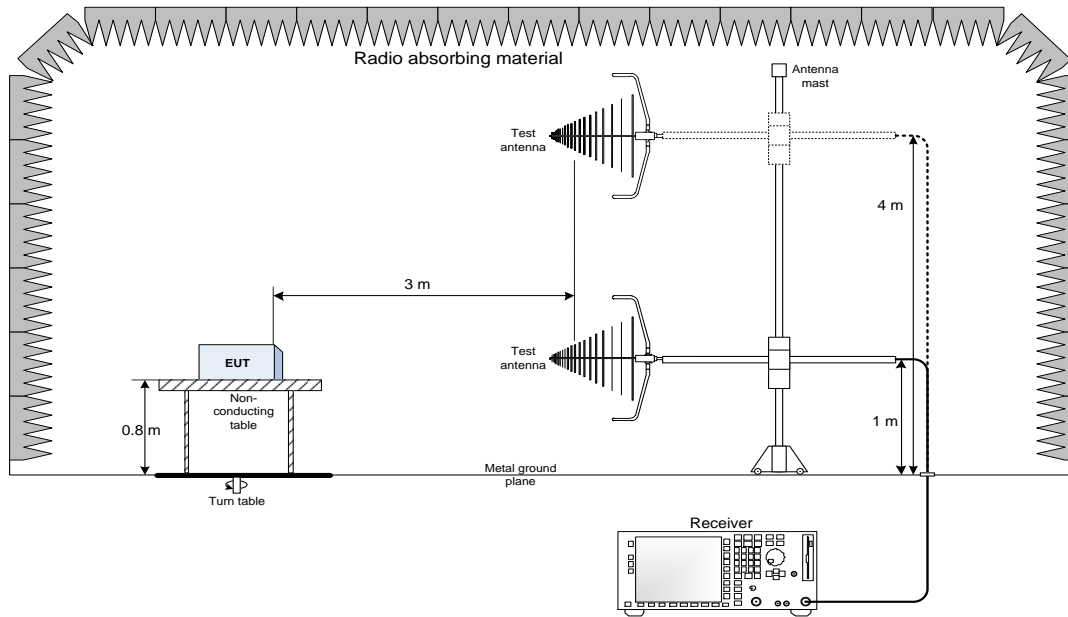


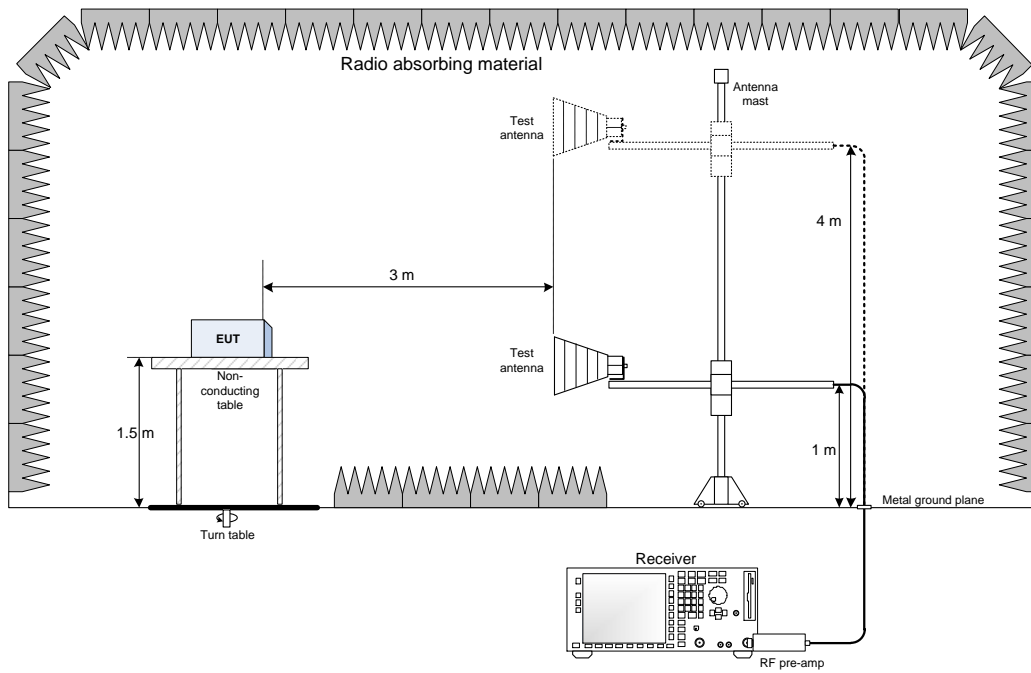
Figure 8.4-4: Occupied bandwidth for LTE + IoT, 20 MHz channel, sample plot

Block diagrams of test set-ups

8.5 Radiated emissions set-up for frequencies below 1 GHz



8.6 Radiated emissions set-up for frequencies above 1 GHz



8.7 Conducted emissions set-up

