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# Test report

## 303472-2TRFWL

Date of issue: October 31, 2017

Applicant:

Intracom S.A. Telecom Solutions

Product:

Point-to-Point Gigabit Radio 60 GHz

Model:

StreetNode 6250 PtP

Part number:

SN6250T-F-2-L-G-AC

Part number variant:

SN6250T-F-2-H-G-DC

FCC ID:

2AHZC-SN6250F12HW16

Specification:

FCC 47 CFR Part 15 Subpart C, §15.255

Operation within the band 57–64 GHz.



Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

FCC 15.255.docx; Date: Aug 2017

ilac-MRA

SCC Accredited LAB
LAB Accrédité CCN

## Test location

| | |
|---|---|
| Company name | Nemko Canada Inc. |
| Address | 303 River Road |
| City | Ottawa |
| Province | Ontario |
| Postal code | K1V 1H2 |
| Country | Canada |
| Telephone | +1 613 737 9680 |
| Facsimile | +1 613 737 9691 |
| Toll free | +1 800 563 6336 |
| Website | www.nemko.com |
| Site number | FCC: CA2040 (3 m semi anechoic chamber) |

| | |
|---|---|
| Tested by | Andrey Adelberg, Senior Wireless/EMC Specialist |
| Reviewed by | Kevin Rose, Wireless/EMC Specialist |
| Date | October 31, 2017 |
| Signature of reviewer |  |

## 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 Canada's ISO/IEC 17025 accreditation.

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# Table of contents

# **Section 1.** Report summary

## 1.1 Applicant and manufacturer

| | |
|---|---|
| Company name | Intracom S.A. Telecom Solutions |
| Address | 19.7 km Markopoulou Ave. |
| City | Peania |
| Province/State | Athens |
| Postal/Zip code | GR-19002 |
| Country | Greece |

## 1.2 Test specifications

| | |
|---|---|
| FCC 47 CFR Part 15, Subpart C, Clause 15.255 | Operation within the band 57–64 GHz |

## 1.3 Test methods

| | |
|---|---|
| ANSI C63.10 v 2013 | American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices |

## 1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See “Summary of test results” for full details.

## 1.5 Exclusions

None

## 1.6 Test report revision history

| Revision # | Details of changes made to test report |
|---|---|
| TRF | Original report issued |
| R1TRF | Updated test report with proper sample test results |

# Section 2. Summary of test results

## 2.1 FCC Part 15 Subpart C test results

| Part | Test description | Verdict |
|---|---|---|
| §15.207(a) | Conducted limits | Pass |
| §15.203 | Antenna requirement | Pass[1] |
| §15.255(b) and (d) | Conducted output power and EIRP requirements | Pass |
| §15.255(c) | Limits on spurious emissions | Pass |
| §15.255(d)(1) | 6 dB BW | Pass |
| §15.255(e) | Frequency stability | Pass |

Notes: [1] The EUT is a professionally installed device and the installer is responsible for ensuring that the proper antenna is employed.

# Section 3. Equipment under test (EUT) details

## 3.1 Sample information

| | |
|---|---|
| Receipt date | June 5, 2017 |
| Nemko sample ID number | 1, 2, 3, 4 |

## 3.2 EUT information

| | |
|---|---|
| Product name | Point-to-Point Gigabit Radio 60 GHz |
| Model | StreetNode 6250 PtP |
| Part number | SN6250T-F-2-L-G-AC |
| Part number variant* | SN6250T-F-2-H-G-DC |
| Serial number | 321612392358 (Low radio) and 321612392371 (High radio) |

* - Part number variants: **SN6250T**-**F**-**2**-u-z-vv: u: **L** (Low radio), **H** (High radio); z: **G** (Grey), **C** (Charcoal Gray); vv: (Supply voltage) **AC** or **DC**

## 3.3 Technical information

| | |
|---|---|
| Frequency band | 57–64 GHz |
| Frequency Min | 58.275 GHz (Low radio), 61.775 GHz (High radio) |
| Frequency Max | 59.275 GHz (Low radio), 62.775 GHz (High radio) |
| Channel BW | 250 MHz |
| Type of modulation | 4-QAM, 16-QAM, 32-QAM, 64-QAM and 128-QAM |
| Emission classification (F1D, G1D, D1D) | W7D |
| Power requirements | AC: 90–240 $V_{AC}$ 50/60 Hz or DC: −40.5 to −60 $V_{DC}$ |
| Antenna information | Internal proprietary antenna with 34 dBi gain<br>The EUT is professionally installed. |

## 3.4 Product description and theory of operation

StreetNode 6250 PTP is an innovative compact all-outdoor native packet radio operating in the 57–64 GHz band (V-Band). It can be used to implement highly-flexible Point-to-Point Microwave (PtP MW) backhaul topologies, reaching challenging small-cell locations and delivering best-in-class connectivity at street level. StreetNode™ 6250 PTP satisfies every critical aspect of 3G and 4G/LTE/LTE-A small-cell backhaul, providing high capacity, low latency, automated provisioning and high availability, while optimizing the small-cell business case economics.

## 3.5 EUT exercise details

EUT was controlled from PC using Windows Terminal to set the transmission on desired channel and modulation type.

## 3.6 EUT setup diagram

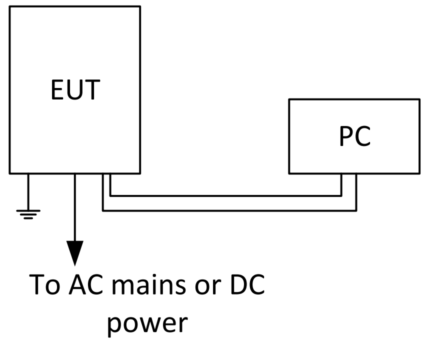



***Figure 3.6-1:*** *Setup diagram*

# Section 4. Engineering considerations

## 4.1 Modifications incorporated in the EUT

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

## 4.2 Technical judgment

None

## 4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

# Section 5. Test conditions

## 5.1 Atmospheric conditions

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

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

## 5.2 Power supply range

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

# Section 6. Measurement uncertainty

## 6.1 Uncertainty of measurement

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

| Test name | Measurement uncertainty, dB |
|---|---|
| All antenna port measurements | 0.55 |
| Conducted spurious emissions | 1.13 |
| Radiated spurious emissions | 3.78 |
| AC power line conducted emissions | 3.55 |

# Section 7. Test equipment

## 7.1 Test equipment list

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

| Equipment | Manufacturer | Model no. | Asset no. | Cal cycle | Next cal. |
|---|---|---|---|---|---|
| 3 m EMI test chamber | TDK | SAC-3 | FA002047 | 1 year | Dec. 1/17 |
| Flush mount turntable | Sunol | FM2022 | FA002082 | — | NCR |
| Controller | Sunol | SC104V | FA002060 | — | NCR |
| Antenna mast | Sunol | TLT2 | FA002061 | — | NCR |
| AC Power source | Chenwa | 2700M-10k | FA002716 | — | VOU |
| DC Power source | Ametek | SGA80X125C-0AAA | FA002737 | — | VOU |
| Spectrum analyzer | Rohde & Schwarz | FSU | FA001877 | 1 year | Jul. 18/18 |
| Horn with Preamp | ETS-Lindgren | 3117-PA | FA002840 | 1 year | Nov. 11/17 |
| Bilog antenna (20–3000 MHz) | Sunol | JB3 | FA002108 | 1 year | June 27/18 |
| Horn antenna (18–40 GHz) | EMCO | 3116 | FA001847 | 1 year | June 27/18 |
| Pre-amplifier (18–26 GHz) | Narda | BBS-1826N612 | FA001550 | — | VOU |
| Pre-amplifier (26–40 GHz) | Narda | DBL-2640N610 | FA001556 | — | VOU |
| Spectrum analyzer | Rohde & Schwarz | FSU | FA001877 | 1 year | Jul. 18/18 |
| 40–60 GHz Harmonic mixer | OML | WR19 M19HWD | FA002322 | 3 year | May. 16/19 |
| 40–60 GHz Standard gain horn | Millitech | U SGH-19 | FA002322 | — | VOU |
| 60–90 GHz Harmonic mixer | OML | WR12 M12HWD | FA001524 | 3 year | May. 16/19 |
| 60–90 GHz Standard gain horn | Millitech | U SGH-12 | FA001524 | — | VOU |
| 90–140 GHz Harmonic mixer | OML | WR08 M08HWD | FA001525 | 3 year | May. 16/19 |
| 90–140 GHz Standard gain horn | Millitech | U SGH-08 | FA001525 | — | VOU |
| 140–220 GHz Harmonic mixer | OML | WR05 M05HWD | FA001526 | 3 year | May. 16/19 |
| 140–220 GHz Standard gain horn | Millitech | U SGH-05 | FA001526 | — | VOU |
| Power meter | Agilent | E4418B | FA001678 | 1 year | May 15/18 |
| Temperature chamber | Thermotron | SM-16C | FA001030 | 1 year | NCR |
| Broadband diode detector | QStar | QEA-FBFBVP | 1416007 | — | NCR |
| 3 GHz scope | Tektronix | TDS694c | FA002505 | 1 year | Oct. 18/17 |
| Waveguide power sensor 50–75 GHz | Keysight | ATV8486A | 77393 | 1 year | Apr 7/18 |

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

# Section 8. Testing data

## 8.1 FCC 15.207(a) AC power line conducted emissions limits

### 8.1.1 Definitions and limits

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

***Table 8.1-1:*** *Conducted emissions limit*

| Frequency of emission, MHz | Conducted limit, dBµV | |
|---|---|---|
| | **Quasi-peak** | **Average**** |
| 0.15–0.5 | 66 to 56* | 56 to 46* |
| 0.5–5 | 56 | 46 |
| 5–30 | 60 | 50 |

Note: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

### 8.1.2 Test summary

| | | | |
|---|---|---|---|
| Test date | August 10, 2017 | Temperature | 21 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1010 mbar |
| Verdict | Pass | Relative humidity | 36 % |

### 8.1.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

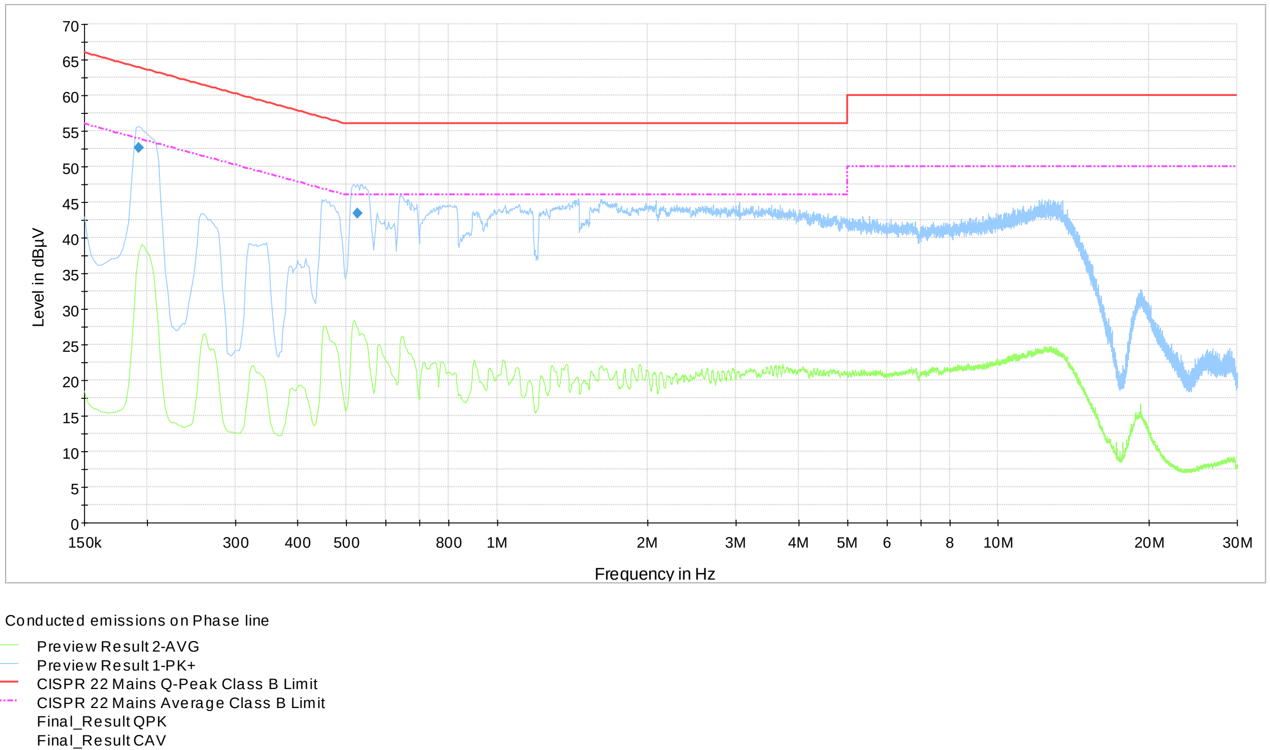
Receiver settings for preview measurements:

| | |
|---|---|
| Resolution bandwidth | 9 kHz |
| Video bandwidth | 30 kHz |
| Detector mode | Peak and Average |
| Trace mode | Max Hold |
| Measurement time | 1000 ms |

Receiver settings for final measurements:

| | |
|---|---|
| Resolution bandwidth | 9 kHz |
| Video bandwidth | 30 kHz |
| Detector mode | Quasi-Peak and Average |
| Trace mode | Max Hold |
| Measurement time | 1000 ms |

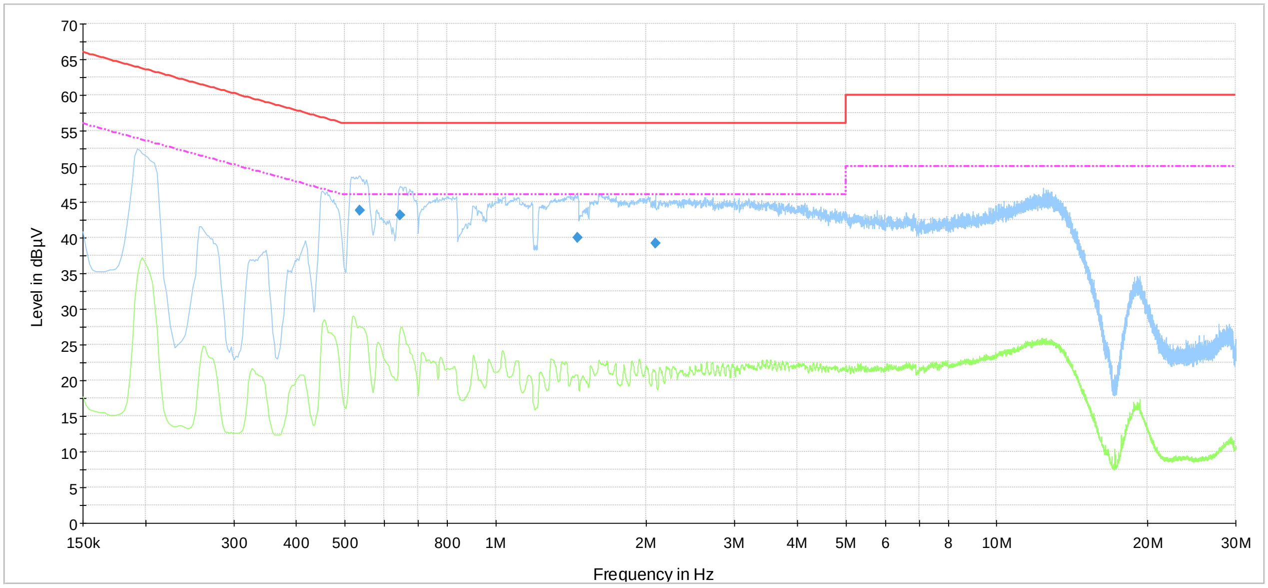
## 8.1.4 Test data




***Plot 8.1-1:** Conducted emissions on phase line*

***Table 8.1-2:** Quasi-Peak conducted emissions results on phase line*

| Frequency, MHz | Q-Peak result, dBµV | Limit, dBµV | Margin, dB | Meas. Time, ms | Bandwidth, kHz | Line | Filter | Correction, dB |
|---|---|---|---|---|---|---|---|---|
| 0.192750 | 52.68 | 63.92 | 11.24 | 100 | 9 | Phase | ON | 9.6 |
| 0.525750 | 43.43 | 56.00 | 12.57 | 100 | 9 | Phase | ON | 9.4 |




Conducted emissions on Neutral line

Preview Result 2-AVG
Preview Result 1-PK+
CISPR 22 Mains Q-Peak Class B Limit
CISPR 22 Mains Average Class B Limit
Final_Result QPK
Final_Result CAV

***Plot 8.1-2:** Conducted emissions on neutral line*

***Table 8.1-3:** Quasi-Peak conducted emissions results on neutral line*

| Frequency, MHz | Q-Peak result, dBµV | Limit, dBµV | Margin, dB | Meas. Time, ms | Bandwidth, kHz | Line | Filter | Correction, dB |
|---|---|---|---|---|---|---|---|---|
| 0.534750 | 43.78 | 56.00 | 12.22 | 100 | 9 | Neutral | ON | 9.4 |
| 0.645000 | 43.10 | 56.00 | 12.90 | 100 | 9 | Neutral | ON | 9.4 |
| 1.459500 | 39.96 | 56.00 | 16.04 | 100 | 9 | Neutral | ON | 9.4 |
| 2.085000 | 39.23 | 56.00 | 16.77 | 100 | 9 | Neutral | ON | 9.4 |

## 8.2 FCC 15.255(b) and (d) Conducted output power and EIRP requirements

### 8.2.1 Definitions and limits

(b) Within the 57–71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):
(ii) For fixed point-to-point transmitters located outdoors, the average power of any emission shall not exceed 82 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi. The peak power of any emission shall not exceed 85 dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi.
(A) The provisions in this paragraph for reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits specified in paragraph (b)(1)(i) of this section.
(B) The provisions of §15.204(c)(2) and (4) that permit the use of different antennas of the same type and of equal or less directional gain do not apply to intentional radiator systems operating under this provision. In lieu thereof, intentional radiator systems shall be certified using the specific antenna(s) with which the system will be marketed and operated. Compliance testing shall be performed using the highest gain and the lowest gain antennas for which certification is sought and with the intentional radiator operated at its maximum available output power level. The responsible party, as defined in §2.909 of this chapter, shall supply a list of acceptable antennas with the application for certification.
(4) The peak power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57–71 GHz band and has a video bandwidth of at least 10 MHz. The average emission levels shall be measured over the actual time period during which transmission occurs.
(d) Except as specified paragraph (d)(1) of this section, the peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak tter output power in order to comply with the EIRP limits specified in paragraph (b) of this section.
(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100-kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).
(2) Peak transmitter conducted output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57–71 GHz band and that has a video bandwidth of at least 10 MHz.
(3) For purposes of demonstrating compliance with this paragraph, corrections to the transmitter conducted output power may be made due to the antenna and circuit loss.

### 8.2.2 Test summary

| | | | |
|---|---|---|---|
| Test date | August 15, 2017 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1005 mbar |
| Verdict | Pass | Relative humidity | 32 % |

### 8.2.3 Observations, settings and special notes

EUT is an outdoor device with an emission bandwidth of more than 100 MHz. Average EIRP limit was calculated as follows: 82 dBm – 2 × (51 dBi – 34 dBi) = 48 dBm. Average output power was measured with power meter. Diode detector was used to find peak to average ratio, then peak level was calculated.

## 8.2.4 Test data

***Table 8.2-1:*** *Conducted average output power and EIRP results for SN6250T-F-2-L-G-AC with 4-QAM modulation*

| Frequency, GHz | Average output power, dBm | Antenna gain, dBi | EIRP, dBm | Average EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|
| 58.275 | 2.30 | 34.00 | 36.30 | 48.00 | 11.70 |
| 58.775 | 1.76 | 34.00 | 35.76 | 48.00 | 12.24 |
| 59.275 | 1.66 | 34.00 | 35.66 | 48.00 | 12.34 |

***Table 8.2-2:*** *Conducted peak output power and EIRP results for SN6250T-F-2-L-G-AC with 4-QAM modulation*

| Frequency, GHz | Peak output power, dBm | Peak output power limit, dBm | Margin, dB | Antenna gain. dBi | EIRP, dBm | EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 58.275 | 3.14 | 27.00 | 23.86 | 34.00 | 37.14 | 51.00 | 13.86 |
| 58.775 | 2.58 | 27.00 | 24.42 | 34.00 | 36.58 | 51.00 | 14.42 |
| 59.275 | 2.42 | 27.00 | 24.58 | 34.00 | 36.42 | 51.00 | 14.58 |

Note: EIRP limit was calculated as follows: 85 dBm – 2 × (51 dBi– 34 dBi) = 51 dBm

***Table 8.2-3:*** *Conducted average output power and EIRP results for SN6250T-F-2-L-G-AC with 128-QAM modulation*

| Frequency, GHz | Average output power, dBm | Antenna gain, dBi | EIRP, dBm | Average EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|
| 58.275 | 2.29 | 34.00 | 36.29 | 48.00 | 11.71 |
| 58.775 | 1.74 | 34.00 | 35.74 | 48.00 | 12.26 |
| 59.275 | 1.66 | 34.00 | 35.66 | 48.00 | 12.34 |

***Table 8.2-4:*** *Conducted peak output power and EIRP results for SN6250T-F-2-L-G-AC with 128-QAM modulation*

| Frequency, GHz | Peak output power, dBm | Peak output power limit, dBm | Margin, dB | Antenna gain. dBi | EIRP, dBm | EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 58.275 | 3.51 | 27.00 | 23.49 | 34.00 | 37.51 | 51.00 | 13.49 |
| 58.775 | 3.02 | 27.00 | 23.98 | 34.00 | 37.02 | 51.00 | 13.98 |
| 59.275 | 2.93 | 27.00 | 24.07 | 34.00 | 36.93 | 51.00 | 14.07 |

Note: EIRP limit was calculated as follows: 85 dBm – 2 × (51 dBi– 34 dBi) = 51 dBm

***Table 8.2-5:*** *Conducted average output power and EIRP results for SN6250-F-2-H-G-DC with 4-QAM modulation*

| Frequency, GHz | Average output power, dBm | Antenna gain, dBi | EIRP, dBm | Average EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|
| 61.775 | 2.07 | 34.00 | 36.07 | 48.00 | 11.93 |
| 62.275 | 2.43 | 34.00 | 36.43 | 48.00 | 11.57 |
| 62.775 | 2.36 | 34.00 | 36.36 | 48.00 | 11.64 |

***Table 8.2-6:*** *Conducted peak output power and EIRP results for SN6250-F-2-H-G-DC with 4-QAM modulation*

| Frequency, GHz | Peak output power, dBm | Peak output power limit, dBm | Margin, dB | Antenna gain. dBi | EIRP, dBm | EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 61.775 | 2.85 | 27.00 | 24.15 | 34.00 | 36.85 | 51.00 | 14.15 |
| 62.275 | 3.27 | 27.00 | 23.73 | 34.00 | 37.27 | 51.00 | 13.73 |
| 62.775 | 3.13 | 27.00 | 23.87 | 34.00 | 37.13 | 51.00 | 13.87 |

Note: EIRP limit was calculated as follows: 85 dBm – 2 × (51 dBi– 34 dBi) = 51 dBm

***Table 8.2-7:*** *Conducted average output power and EIRP results for SN6250-F-2-H-G-DC with 128-QAM modulation*

| Frequency, GHz | Average output power, dBm | Antenna gain, dBi | EIRP, dBm | Average EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|
| 61.775 | 2.01 | 34.00 | 36.01 | 48.00 | 11.99 |
| 62.275 | 2.27 | 34.00 | 36.27 | 48.00 | 11.73 |
| 62.775 | 2.21 | 34.00 | 36.21 | 48.00 | 11.79 |

***Table 8.2-8:*** *Conducted peak output power and EIRP results for SN6250-F-2-H-G-DC with 128-QAM modulation*

| Frequency, GHz | Peak output power, dBm | Peak output power limit, dBm | Margin, dB | Antenna gain. dBi | EIRP, dBm | EIRP limit, dBm | Margin, dB |
|---|---|---|---|---|---|---|---|
| 61.775 | 3.26 | 27.00 | 23.74 | 34.00 | 37.26 | 51.00 | 13.74 |
| 62.275 | 3.49 | 27.00 | 23.51 | 34.00 | 37.49 | 51.00 | 13.51 |
| 62.775 | 3.45 | 27.00 | 23.55 | 34.00 | 37.45 | 51.00 | 13.55 |

Note: EIRP limit was calculated as follows: 85 dBm – 2 × (51 dBi– 34 dBi) = 51 dBm

***Table 8.2-9:*** *Peak measurement details, sample calculation*

| RMS power measurement, dBm | RMS power measurement, mW | RMS voltage, $V_{RMS}$ | Peak voltage, $V_{Peak}$ | Peak power equivalent, mW | Peak power, dBm |
|---|---|---|---|---|---|
| 2.01 | 1.588 | 12.08 | 16.11 | 2.118 | 3.26 |

Note: The measurement was performed using a diode detector with its output connected to an oscilloscope. RMS and Peak voltage measurements were performed and peak power was extrapolated from the peak voltage measurement.

Sample calculation: 1.588 mW input power yielded 12.08 $V_{RMS}$; Peak measurement of the same signal was 16.11 $V_{Peak}$. Peak power was extrapolated using the following equation: $P_{Peak} = P_{RMS} \times (V_{Peak} / V_{RMS})$

## 8.3 FCC 15.255(c) Limits on spurious emissions

### 8.3.1 Definitions and limits

(1) The power density of any emissions outside the 57–64 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² (85.3 dBμV/m) at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

***Table 8.3-1:*** *FCC §15.209 – Radiated emission limits*

| Frequency, MHz | Field strength of emissions | | Measurement distance, m |
|---|---|---|---|
| | μV/m | dBμV/m | |
| 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 8.3-2:*** *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 | | | |

## 8.3.2 Test summary

| | | | |
|---|---|---|---|
| Test date | August 8, 2017 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1009 mbar |
| Verdict | Pass | Relative humidity | 32 % |

## 8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 220 GHz.
Radiated measurements were performed at a distance of 3 m for frequencies below 18 GHz, 1 m within 18–40 GHz, and 3 cm for frequencies above 40 GHz.
Limit line calculation for frequencies above 40 GHz: 85.3 dBµV/m + 20 × Log (3/0.03) = 85.3 + 40 dB = 125.3 dBµV/m

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

| | |
|---|---|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | 300 kHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

| | |
|---|---|
| Resolution bandwidth | 1 MHz |
| Video bandwidth | 3 MHz |
| Detector mode | Peak |
| Trace mode | Max Hold |

## 8.3.4 Test data

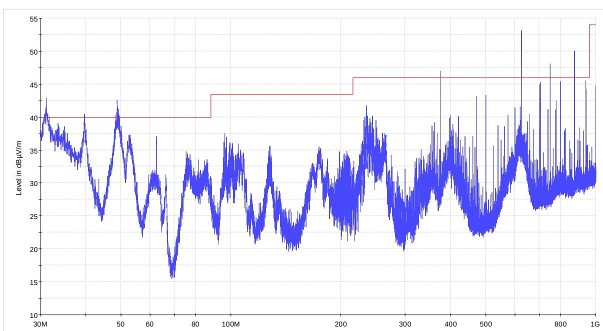



***Figure 8.3-1:*** *Spurious emissions below 1 GHz for SN6250T-F-2-L-G-AC, low channel*

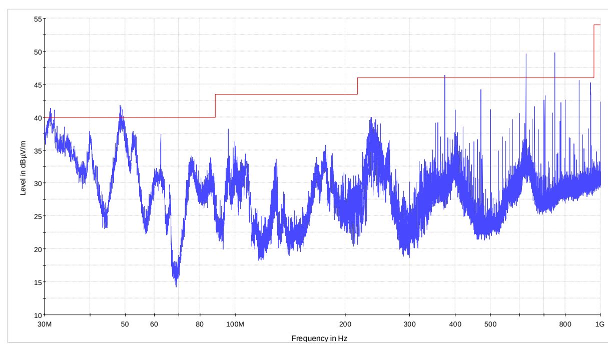



***Figure 8.3-2:*** *Spurious emissions below 1 GHz for SN6250T-F-2-L-G-AC, high channel*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

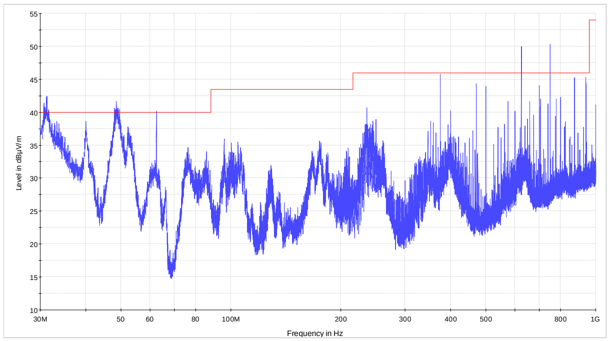



***Figure 8.3-3:*** *Spurious emissions below 1 GHz for SN6250T-F-2-L-G-AC, transmitter turned off (digital emissions)*

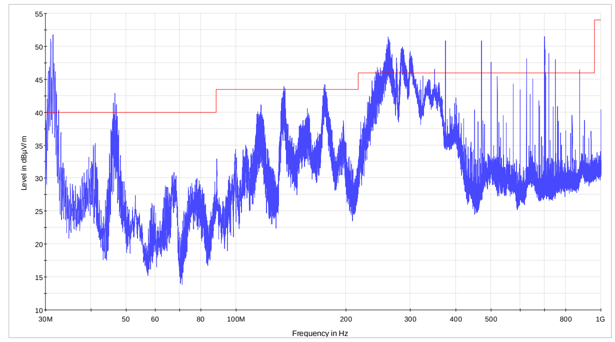



***Figure 8.3-4:*** *Spurious emissions below 1 GHz for SN6250T-F-2-H-G-DC, low channel*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

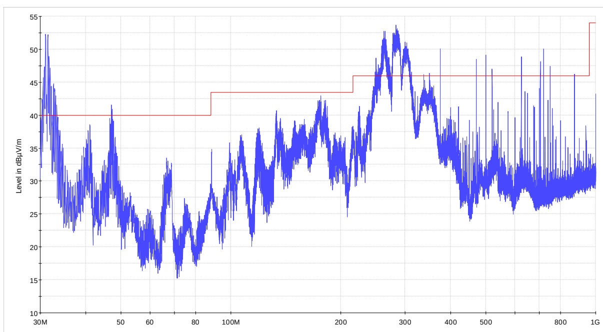



***Figure 8.3-5:*** *Spurious emissions below 1 GHz for SN6250T-F-2-H-G-DC, high channel*

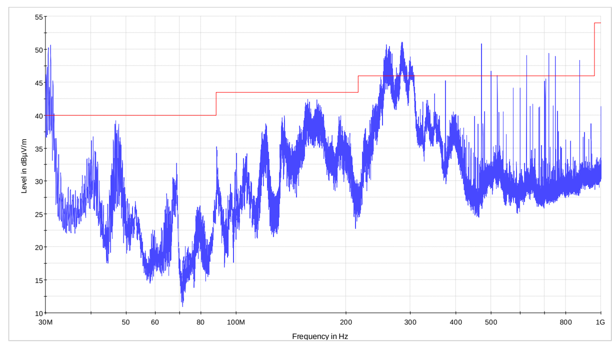



***Figure 8.3-6:*** *Spurious emissions below 1 GHz for SN6250T-F-2-H-G-DC, transmitter turned off*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

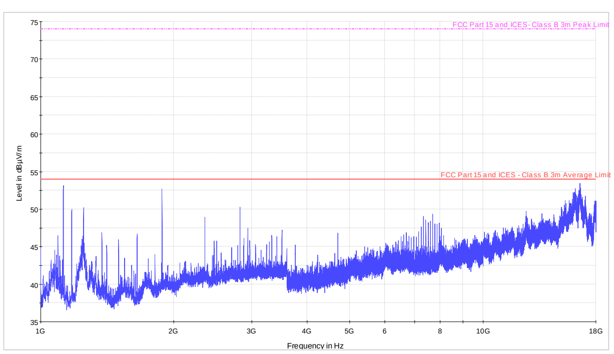



***Figure 8.3-7:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-L-G-AC, low channel*

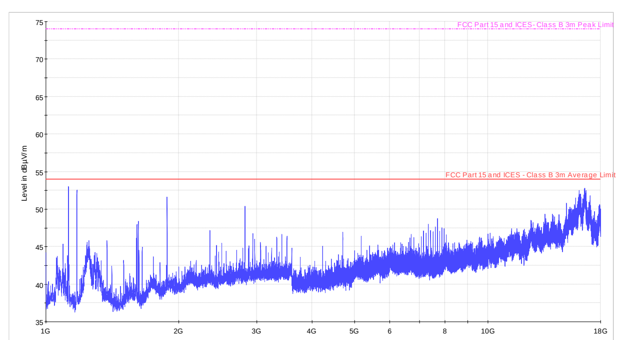



***Figure 8.3-8:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-L-G-AC, high channel*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

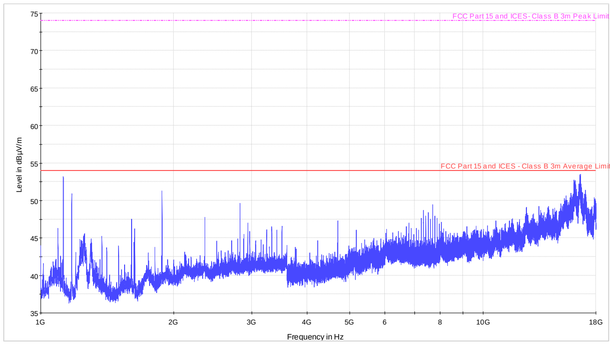



***Figure 8.3-9:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-L-G-AC, transmitter turned off*

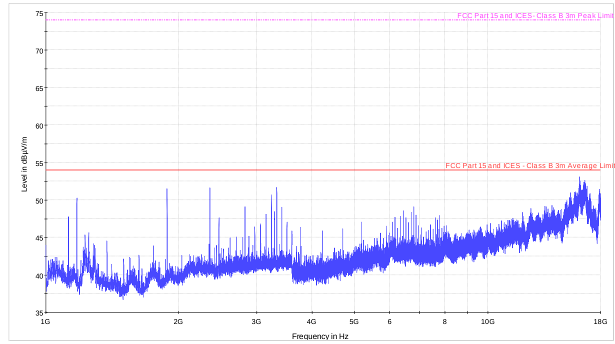



***Figure 8.3-10:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-H-G-DC, low channel*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

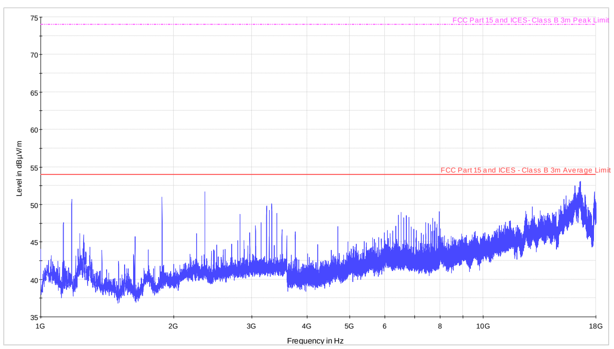



***Figure 8.3-11:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-H-G-DC, high channel*

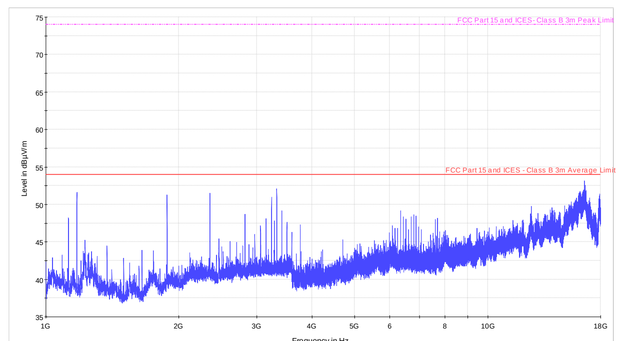



***Figure 8.3-12:*** *Spurious emissions within 1–18 GHz for SN6250T-F-2-H-G-DC, transmitter turned off*

Note: EUT is a Class A equipment for unintentional radiation. All radiated peaks measured and shown on the plots above are digital emissions and therefore exempt from the requirements of RF spurious emissions.

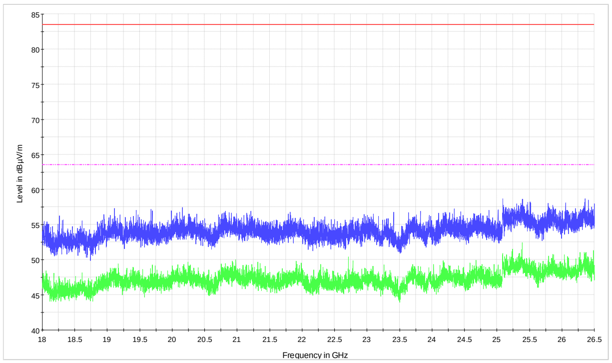



***Figure 8.3-13:*** *Spurious emissions within 18–26.5 GHz for SN6250T-F-2-L-G-AC, low channel*

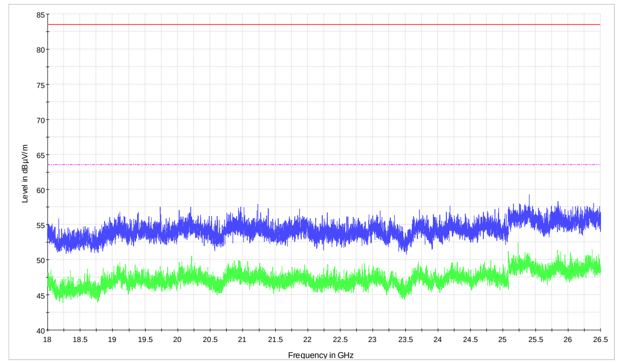



***Figure 8.3-14:*** *Spurious emissions within 18–26.5 GHz for SN6250T-F-2-L-G-AC, high channel*

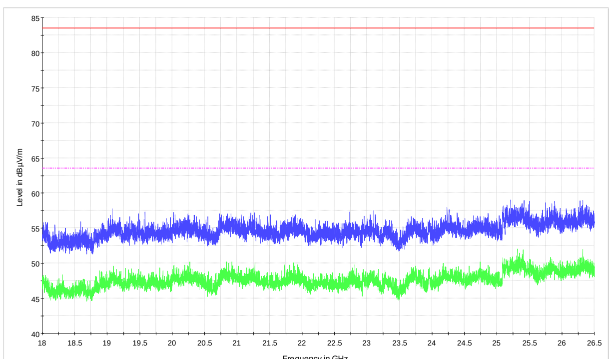



***Figure 8.3-15:*** *Spurious emissions within 18–26.5 GHz for SN6250T-F-2-H-G-DC, low channel*

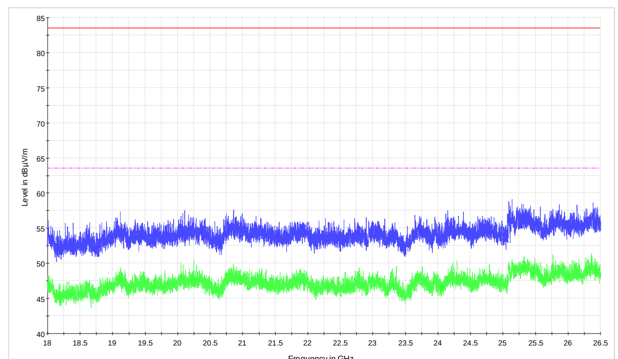



***Figure 8.3-16:*** *Spurious emissions within 26.5–40 GHz for SN6250T-F-2-H-G-DC, high channel*

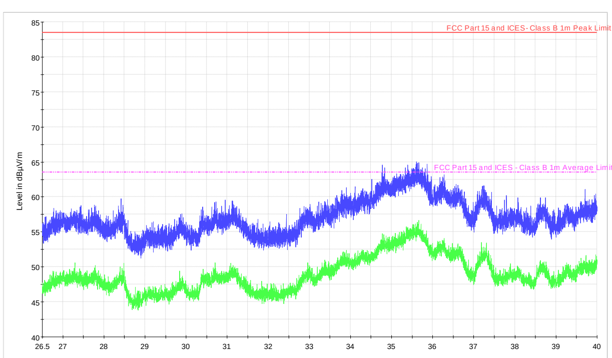



***Figure 8.3-17:*** *Spurious emissions within 26.5–40 GHz for SN6250T-F-2-L-G-AC, low channel*

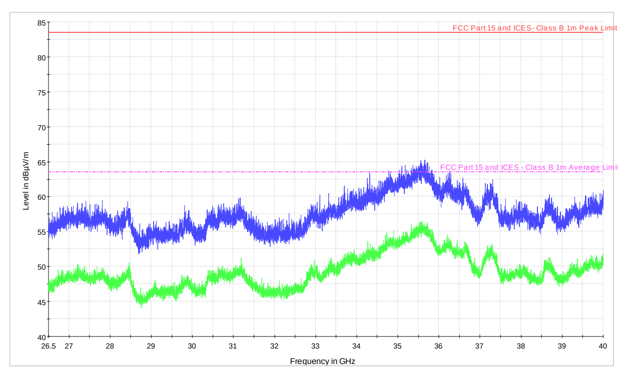



***Figure 8.3-18:*** *Spurious emissions within 26.5–40 GHz for SN6250T-F-2-L-G-AC, high channel*

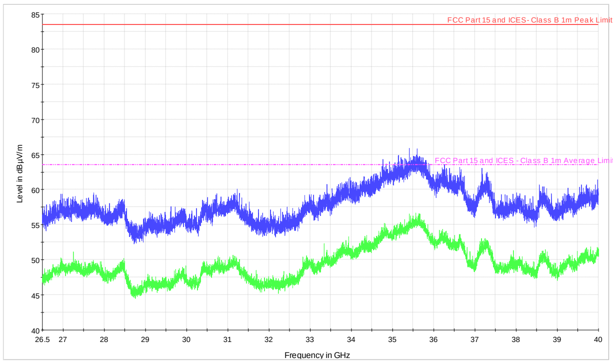



***Figure 8.3-19:*** *Spurious emissions within 26.5–40 GHz for SN6250T-F-2-H-G-DC, low channel*

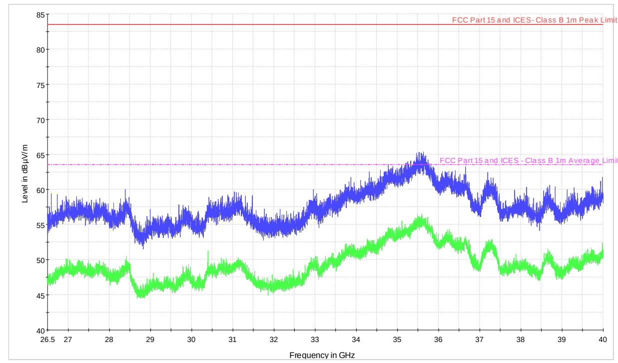



***Figure 8.3-20:*** *Spurious emissions within 26.5–40 GHz for SN6250T-F-2-H-G-DC, high channel*

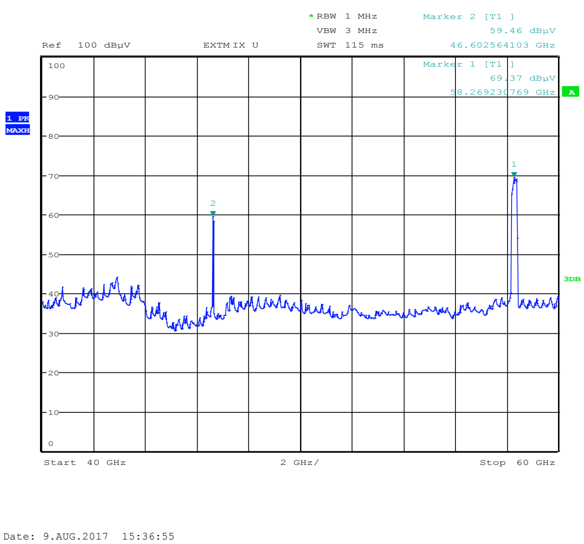



***Figure 8.3-21:*** *Spurious emissions within 40–60 GHz for SN6250T-F-2-L-G-AC, low channel*

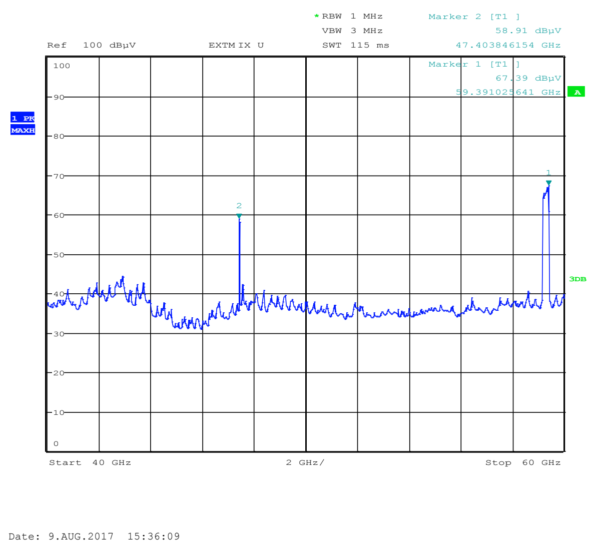



***Figure 8.3-22:*** *Spurious emissions within 40–60 GHz for SN6250T-F-2-L-G-AC, high channel*

Note: The spur in the plots is the image of the intermodulation product of the external mixer (except for fundamental peak).
LO within this frequency range is between 11.5 to 12.5 GHz. These are not actual emissions of the EUT.

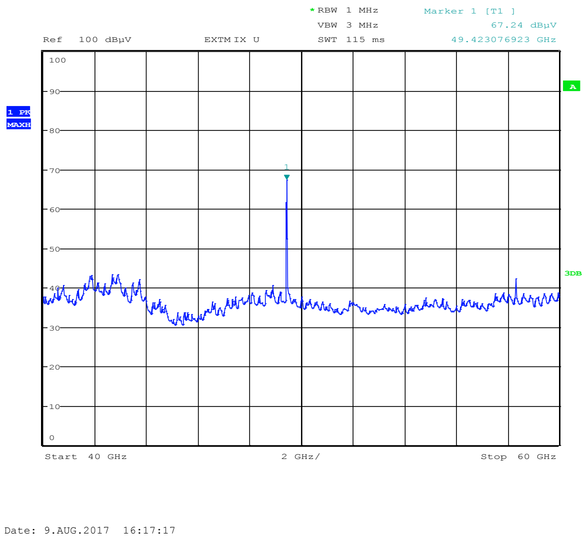



***Figure 8.3-23:*** *Spurious emissions within 40–60 GHz for SN6250T-F-2-H-G-DC, low channel*

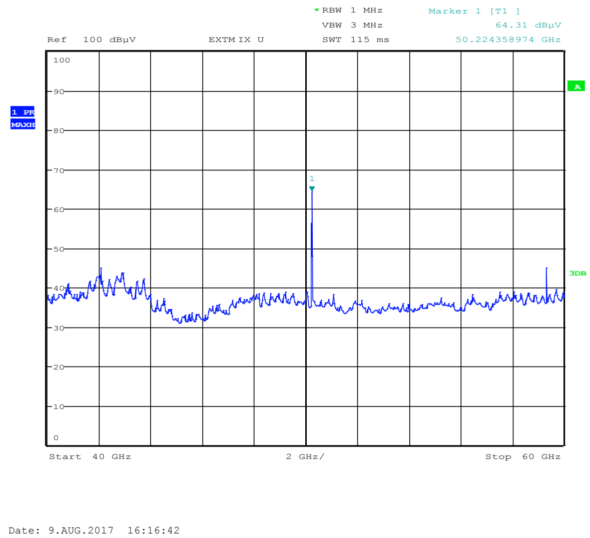



***Figure 8.3-24:*** *Spurious emissions within 40–60 GHz for SN6250T-F-2-H-G-DC, high channel*

Note: limit line is at 125 dBµV/m (including distance correction).

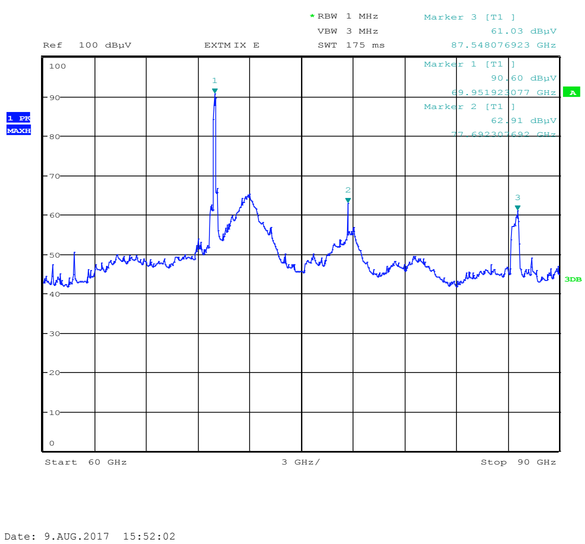



***Figure 8.3-25:*** *Spurious emissions within 60–90 GHz for SN6250T-F-2-L-G-AC, low channel*

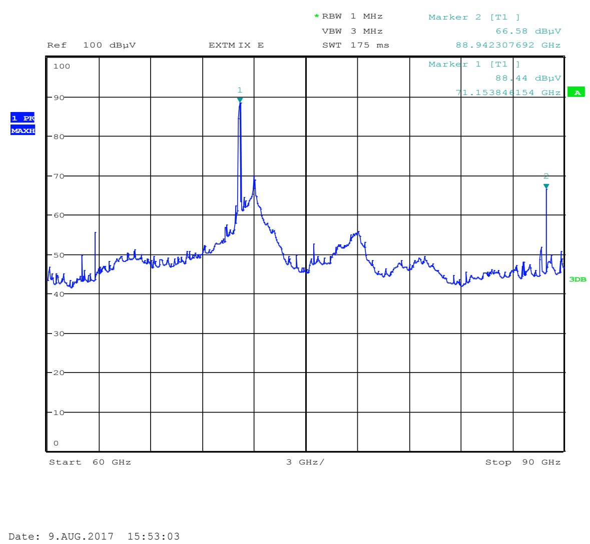



***Figure 8.3-26:*** *Spurious emissions within 60–90 GHz for SN6250T-F-2-L-G-AC, high channel*

Note: limit line is at 125 dBµV/m (including distance correction).

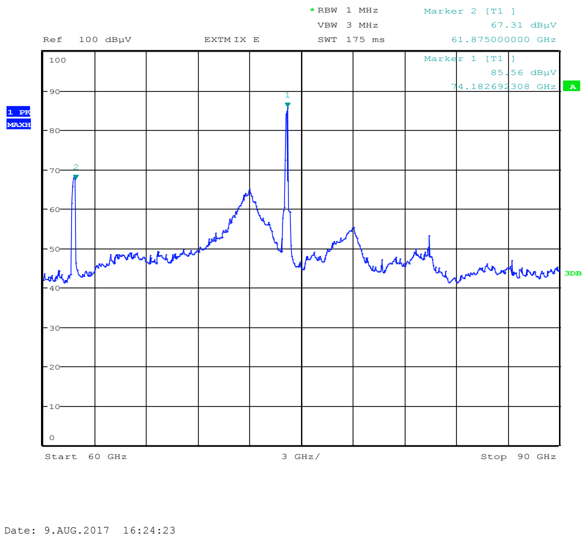



***Figure 8.3-27:*** *Spurious emissions within 60–90 GHz for SN6250T-F-2-H-G-DC, low channel*

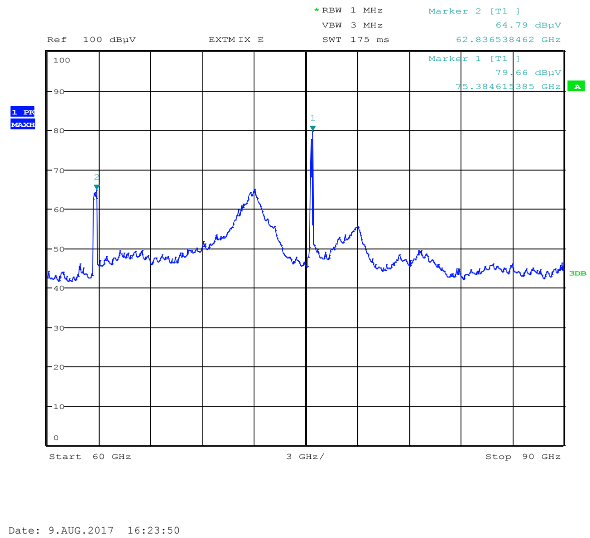



***Figure 8.3-28:*** *Spurious emissions within 60–90 GHz for SN6250T-F-2-H-G-DC, high channel*

Note: The spur in the plots is the image of the intermodulation product of the external mixer (except for fundamental peak). LO within this frequency range is between 11.5 to 12.5 GHz. These are not actual emissions of the EUT.

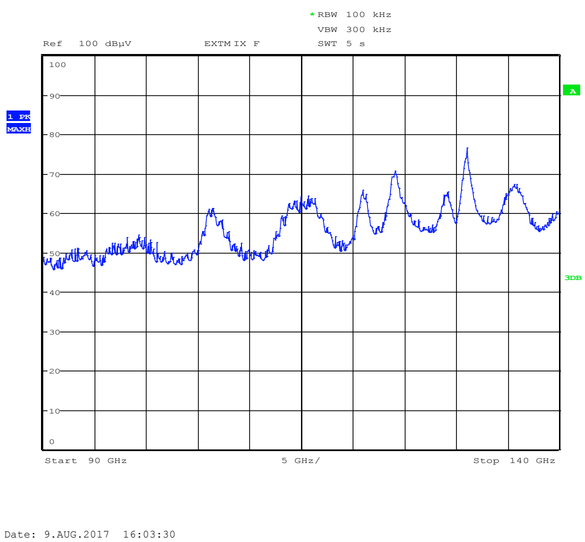



***Figure 8.3-29:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-L-G-AC, low channel*

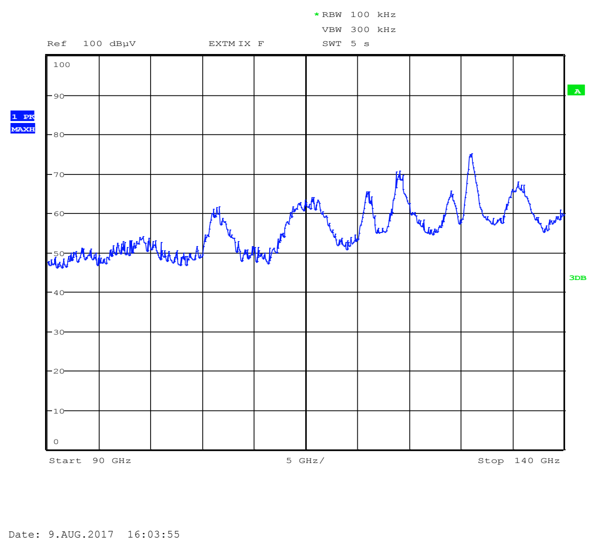



***Figure 8.3-30:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-L-G-AC, high channel*

Note: RBW was reduced to 100 kHz in order to increase dynamic range and verify that there are no spurious emissions underneath the noise floor.

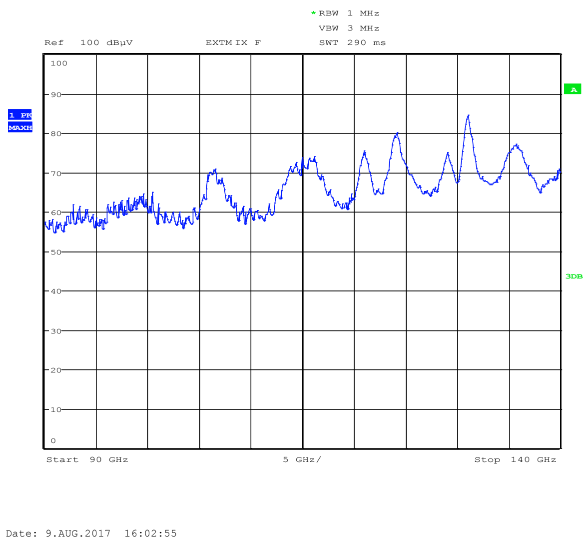



***Figure 8.3-31:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-L-G-AC, low channel, 1 MHz RBW*

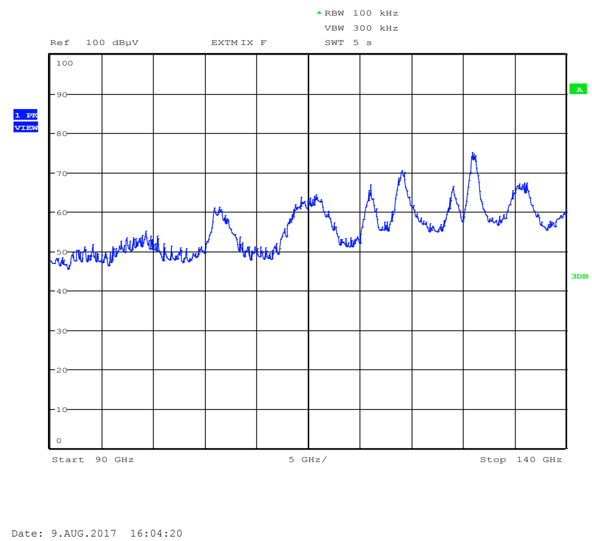



***Figure 8.3-32:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-L-G-AC, Tx off*

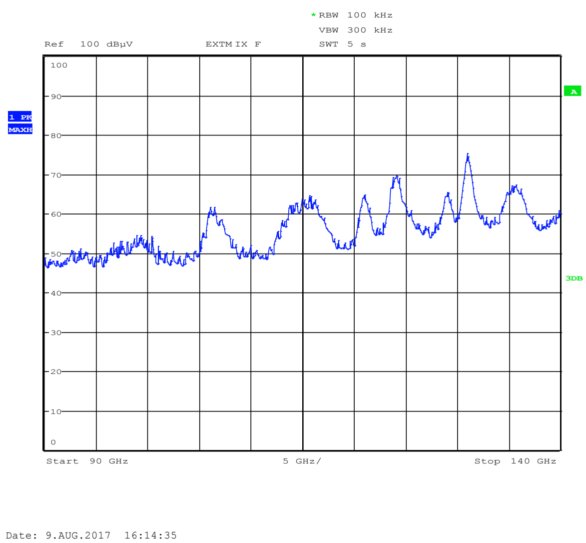



***Figure 8.3-33:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-H-G-DC, low channel*

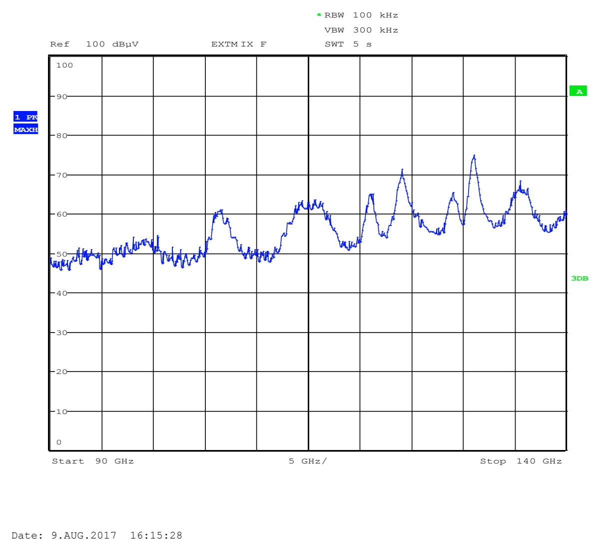



***Figure 8.3-34:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-H-G-DC, high channel*

Note: RBW was reduced to 100 kHz in order to increase dynamic range and verify that there are no spurious emissions underneath the noise floor.

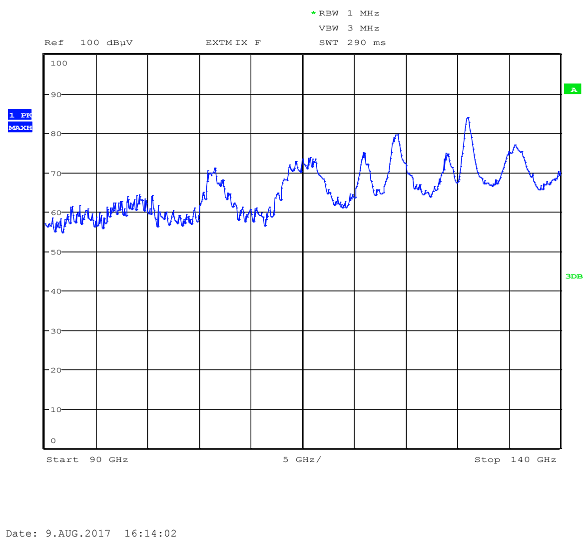



***Figure 8.3-35:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-H-G-DC, low channel, 1 MHz RBW*

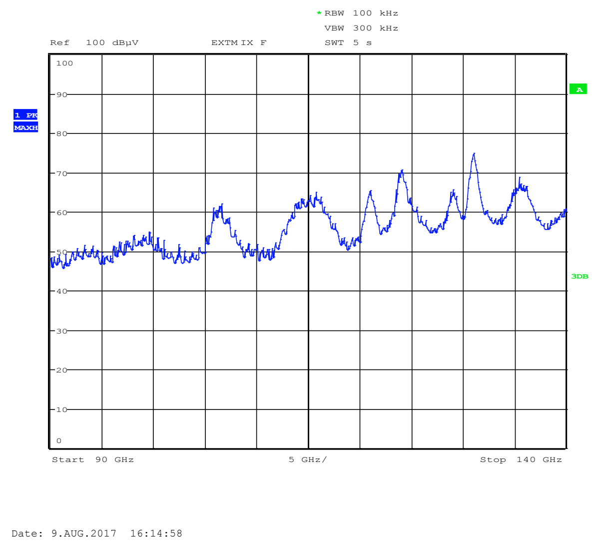



***Figure 8.3-36:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-H-G-DC, Tx off*

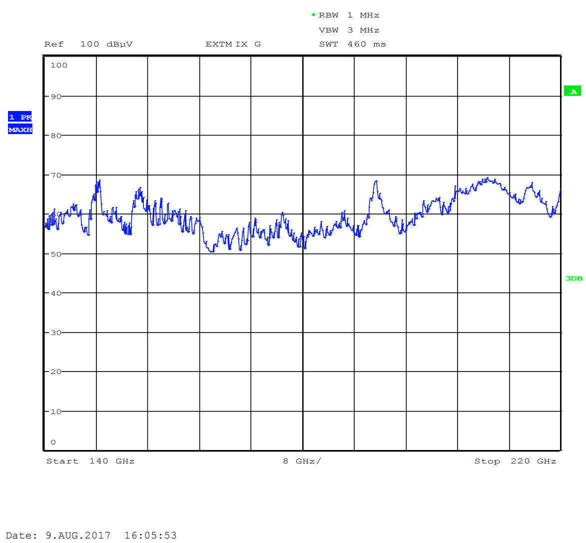



***Figure 8.3-37:*** *Spurious emissions within 140–220 GHz for STN6250T F-1-L-C-AC*

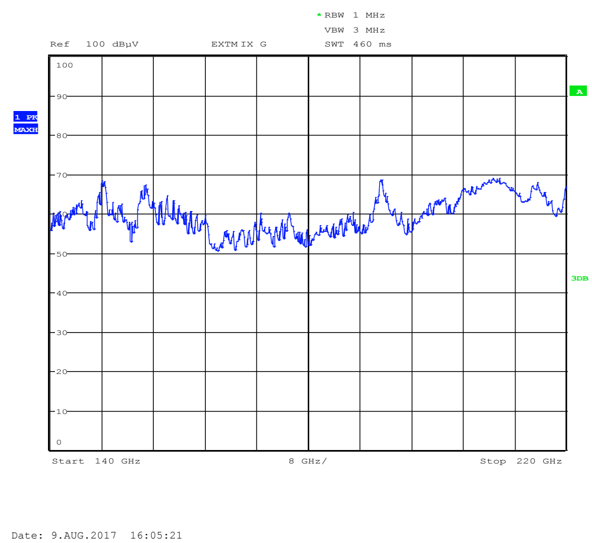



***Figure 8.3-38:*** *Spurious emissions within 140–220 GHz for SN6250T-F-2-L-G-AC*

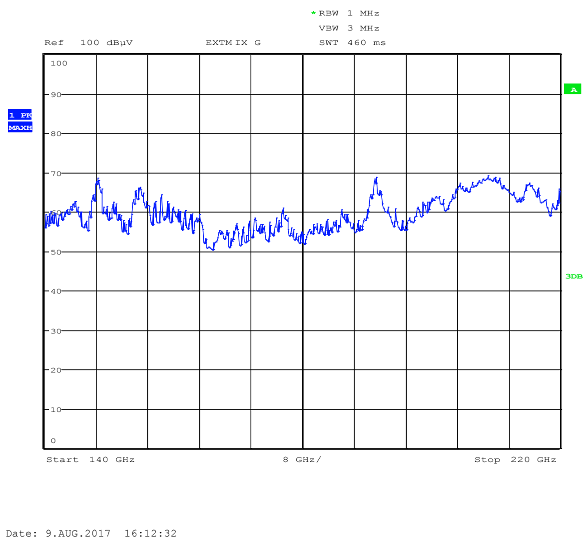



***Figure 8.3-39:*** *Spurious emissions within 140–220 GHz for STN6250T F-1-H-C-DC*

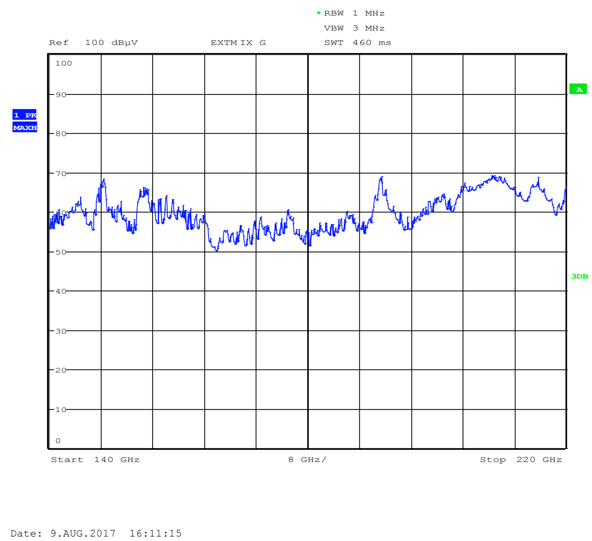



***Figure 8.3-40:*** *Spurious emissions within 90–140 GHz for SN6250T-F-2-H-G-DC*

## 8.4 FCC 15.255(d)(1) 6 dB bandwidth

### 8.4.1 Definitions and limits

(d)(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).

### 8.4.2 Test summary

### 8.4.3 Test summary

| | | | |
|---|---|---|---|
| Test date | August 17, 2017 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1008 mbar |
| Verdict | Pass | Relative humidity | 31 % |

### 8.4.4 Observations, settings and special notes

Spectrum analyser settings:

| | |
|---|---|
| Resolution bandwidth | 100 kHz |
| Video bandwidth | ≥ 3 × RBW |
| Frequency span | Wider than emission bandwidth |
| Detector mode | Peak |

### 8.4.5 Test data

***Table 8.4-1:*** *6 dB bandwidth measurement results*

| Radio | Minimum 6 dB bandwidth, MHz | High power minimum limit, MHz | Margin, MHz |
|---|---|---|---|
| **SN6250T-F-2-L-G-AC** | 234.775 | 100.000 | 134.775 |
| **SN6250T-F-2-H-G-DC** | 229.167 | 100.000 | 129.617 |

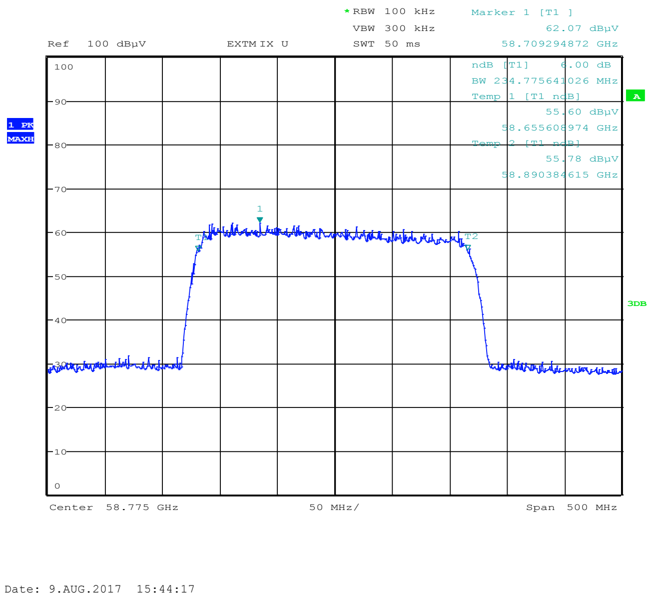



***Figure 8.4-1:*** *6 dB band width sample plot*

## 8.5 FCC 15.255(e) Frequency stability

### 8.5.1 Definitions and limits

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

### 8.5.2 Test summary

| | | | |
|---|---|---|---|
| Test date | March 31, 2016 | Temperature | 22 °C |
| Test engineer | Andrey Adelberg | Air pressure | 1008 mbar |
| Verdict | Pass | Relative humidity | 31 % |

### 8.5.3 Observations, settings and special notes

**Low radio:**
Lower channel band edge was calculated as follows: 58.275 GHz – half of declared (250 MHz) channel bandwidth.
Upper channel band edge was calculated as follows: 59.275 GHz + half of declared (250 MHz) channel bandwidth.

**High radio:**
Lower channel band edge was calculated as follows: 61.775 GHz – half of declared (250 MHz) channel bandwidth.
Upper channel band edge was calculated as follows: 62.775 GHz + half of declared (250 MHz) channel bandwidth.

### 8.5.4 Test data

***Table 8.5-1:*** *Frequency drift measurement for Low radio*

| Test conditions | Frequency, GHz | Drift, kHz |
|---|---|---|
| +50 °C, 120 $V_{AC}$ | 58.274800562 | -199.438 |
| +40 °C, 120 $V_{AC}$ | 58.274914822 | -85.178 |
| +30 °C, 120 $V_{AC}$ | 58.275134753 | 134.753 |
| +20 °C, +15 % (132 $V_{AC}$) | 58.274910255 | -89.745 |
| +20 °C, 120 $V_{AC}$ | 58.274906957 | -93.043 |
| +20 °C, −15 % (108 $V_{AC}$) | 58.274952618 | -47.382 |
| +10 °C, 120 $V_{AC}$ | 58.274892187 | -107.813 |
| 0 °C, 120 $V_{AC}$ | 58.274917495 | -82.505 |
| −10 °C, 120 $V_{AC}$ | 58.274944241 | -55.759 |
| −20 °C, 120 $V_{AC}$ | 58.275030452 | 30.452 |

Note: the drift was calculated as follows: Measured frequency − Declared frequency (58.275 GHz)

***Table 8.5-2:*** *Lower band edge drift calculation for Low radio*

| Lower channel band edge, GHz | Max negative drift, kHz | Drifted lower channel band edge, GHz | Lower band edge limit, GHz | Margin, GHz |
|---|---|---|---|---|
| 58.1500 | 199.4380 | 58.149800562 | 57.0000 | 1.149800562 |

Notes: Drifted lower channel band edge = Lower channel band edge – max negative drift.

***Table 8.5-3:*** *Upper band edge drift calculation for Low radio*

| Upper channel band edge, GHz | Max positive drift, kHz | Drifted upper channel band edge, GHz | Upper band edge limit, GHz | Margin, GHz |
|---|---|---|---|---|
| 59.4000 | 134.7530 | 59.400134753 | 64.0000 | 4.599865247 |

Notes: Drifted upper channel band edge = Upper channel band edge + max positive drift.

***Table 8.5-4:*** *Frequency drift measurement for High radio*

| Test conditions | Frequency, GHz | Drift, kHz |
|---|---|---|
| +50 °C, 48 $V_{DC}$ | 62.775006355 | 6.355 |
| +40 °C, 48 $V_{DC}$ | 62.774878401 | -121.599 |
| +30 °C, 48 $V_{DC}$ | 62.774958920 | -41.080 |
| +20 °C, +15 % (55.2 $V_{AC}$) | 62.774822244 | -177.756 |
| +20 °C, 48 $V_{DC}$ | 62.775045091 | 45.091 |
| +20 °C, −15 % (40.8 $V_{AC}$) | 62.774783641 | -216.359 |
| +10 °C, 48 $V_{DC}$ | 62.774839268 | -160.732 |
| 0 °C, 48 $V_{DC}$ | 62.774790323 | -209.677 |
| −10 °C, 48 $V_{DC}$ | 62.774813536 | -186.464 |
| −20 °C, 48 $V_{DC}$ | 62.774817794 | -182.206 |

Note: the drift was calculated as follows: Measured frequency − Declared frequency (62.775 GHz)

***Table 8.5-5:*** *Lower band edge drift calculation for High radio*

| Lower channel band edge, GHz | Max negative drift, kHz | Drifted lower channel band edge, GHz | Lower band edge limit, GHz | Margin, GHz |
|---|---|---|---|---|
| 58.1500 | 209.6670 | 58.149790333 | 57.0000 | 1.149790333 |

Notes: Drifted lower channel band edge = Lower channel band edge – max negative drift.

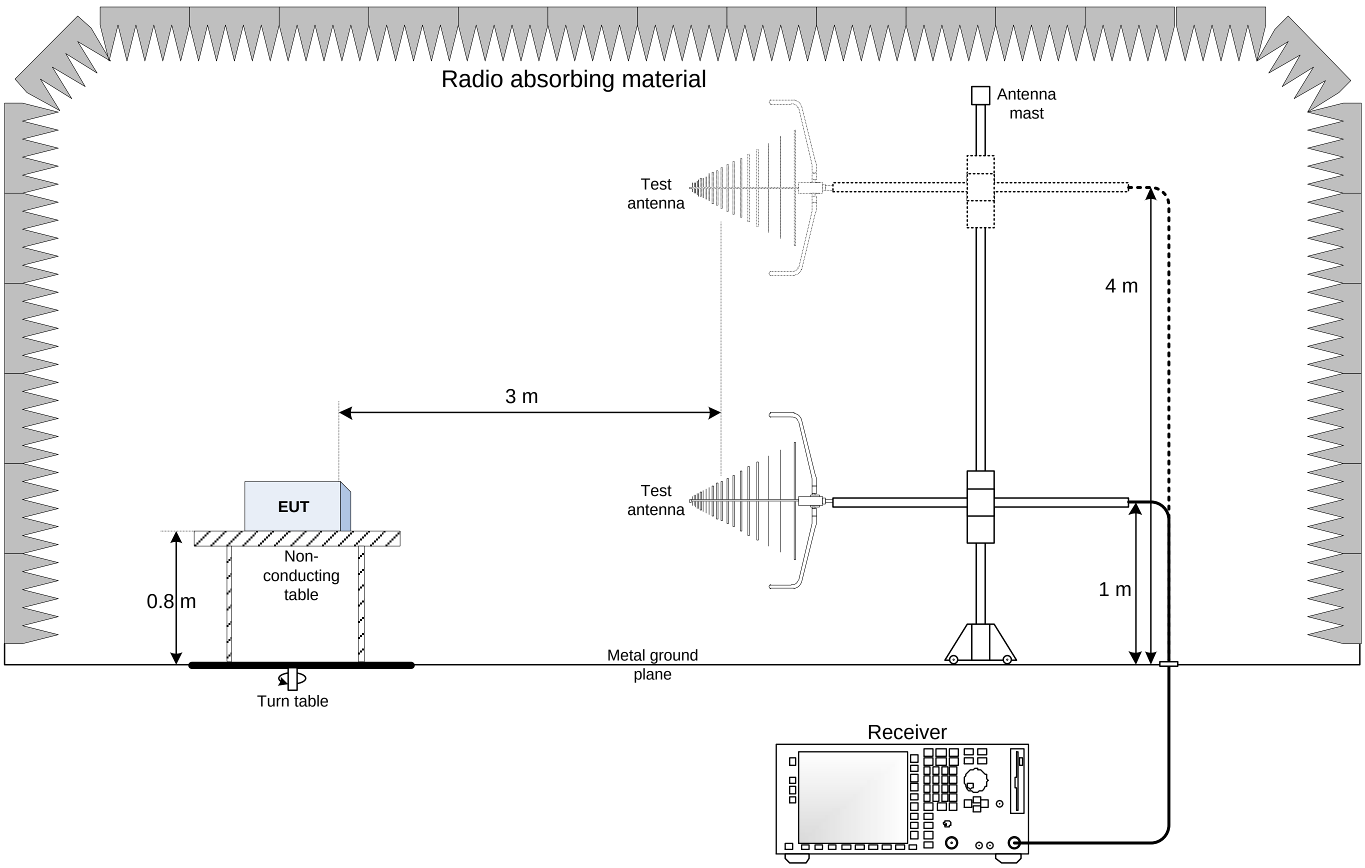
***Table 8.5-6:*** *Upper band edge drift calculation for High radio*

| Upper channel band edge, GHz | Max positive drift, kHz | Drifted upper channel band edge, GHz | Upper band edge limit, GHz | Margin, GHz |
|---|---|---|---|---|
| 62.9000 | 45.0910 | 62.900045091 | 64.0000 | 1.099954909 |

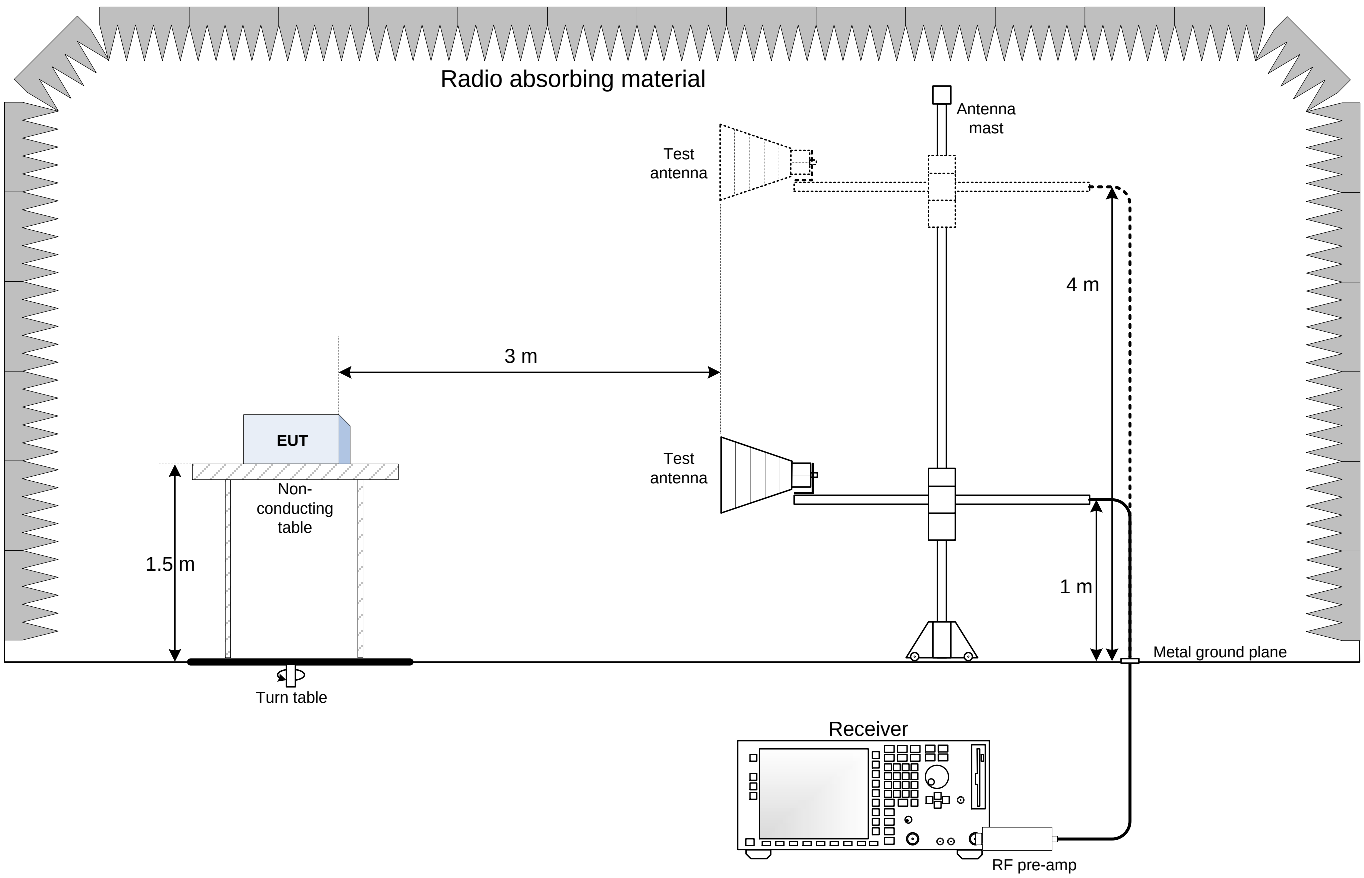
Notes: Drifted upper channel band edge = Upper channel band edge + max positive drift.

# Section 9. Block diagrams of test set-ups

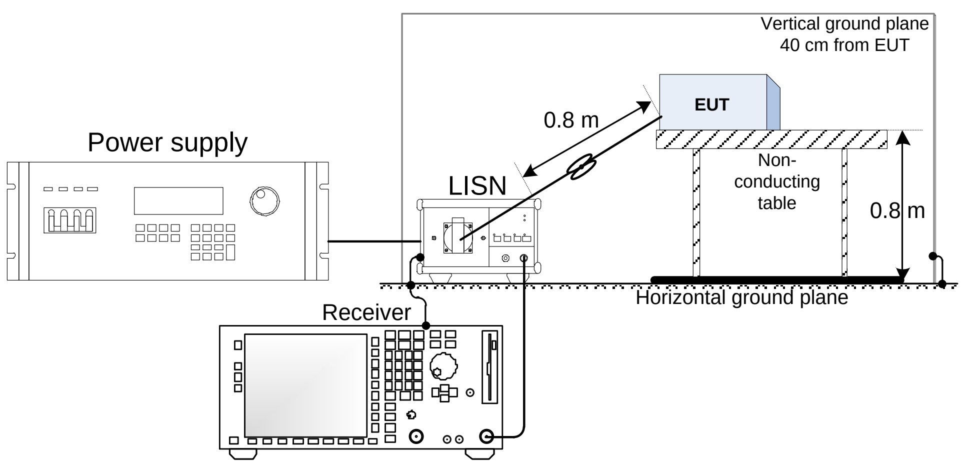
## 9.1 Radiated emissions set-up for frequencies below 1 GHz



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




## 9.3 Conducted emissions set-up



## 9.4 Conducted power measurement set-up