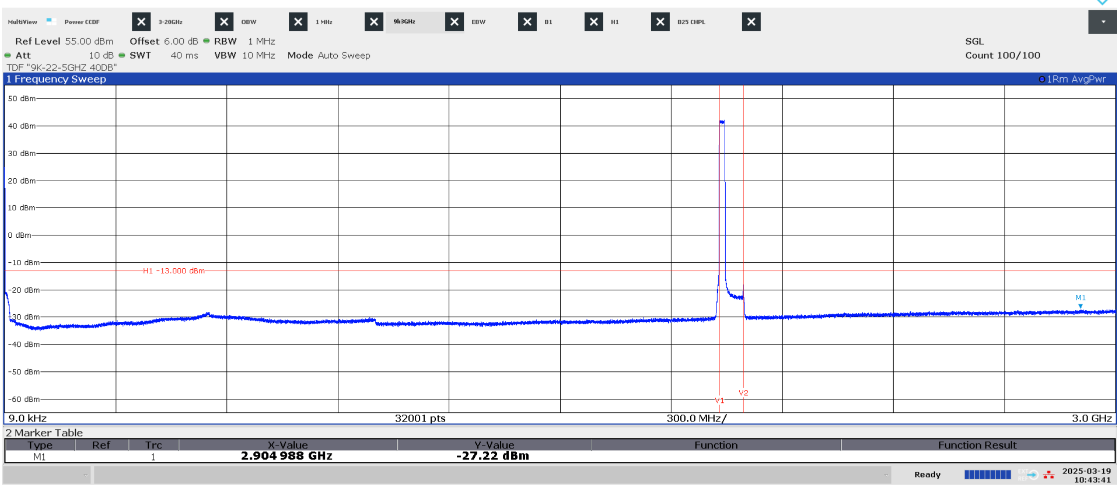
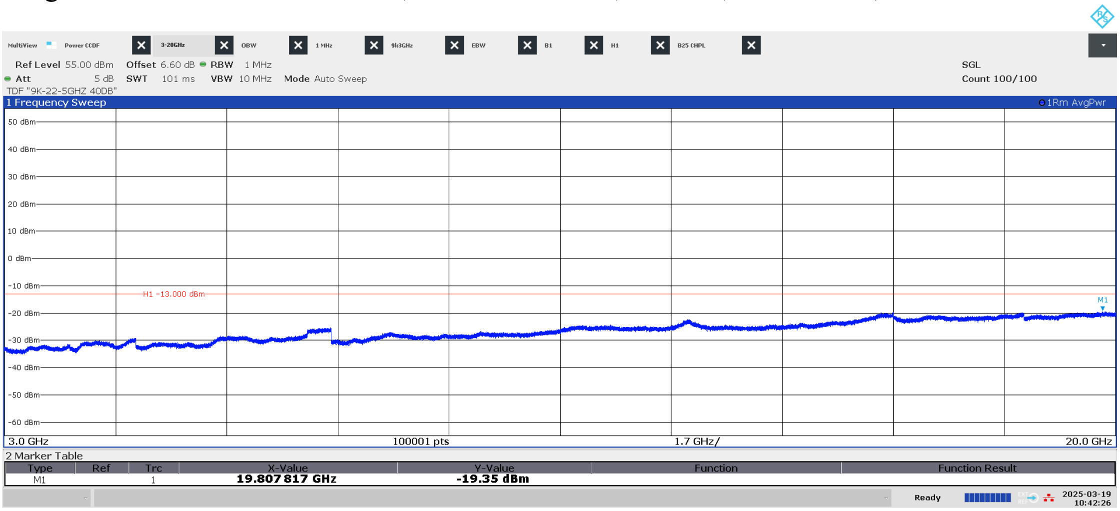
Diagram 3.35a NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+15NR}$, 9 kHz – 3 GHz, Port A



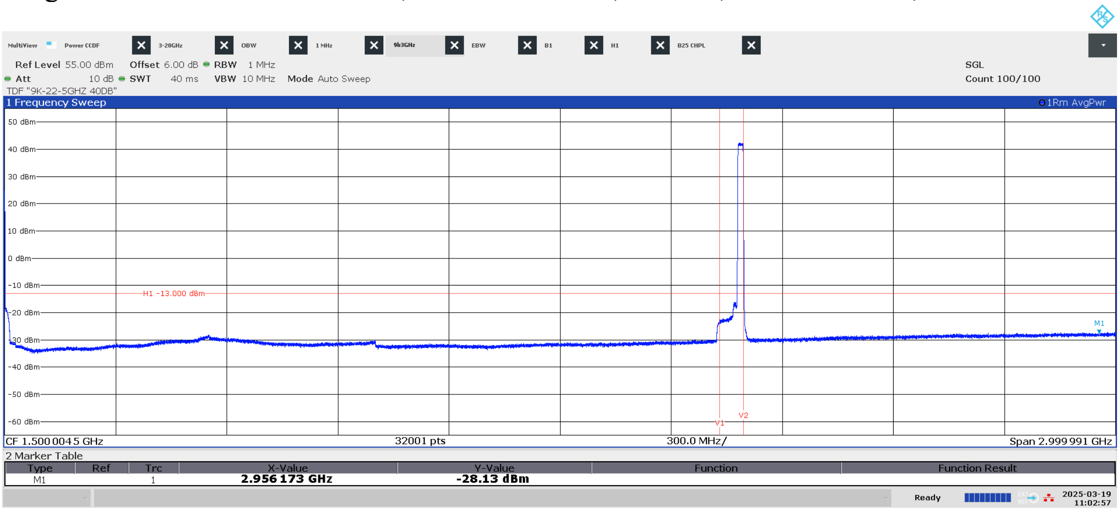
10:43:41 AM 03/19/2025

Diagram 3.35b NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+15NR}$, 3 – 20 GHz, Port A:



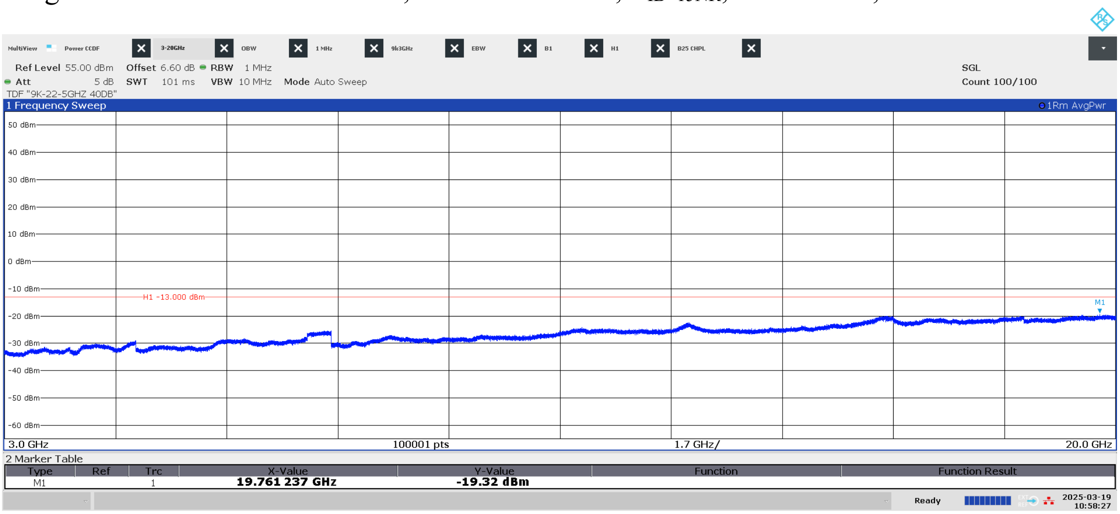
10:42:26 AM 03/19/2025

Diagram 3.36a NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+15NR}$, 9 kHz – 3 GHz, Port A



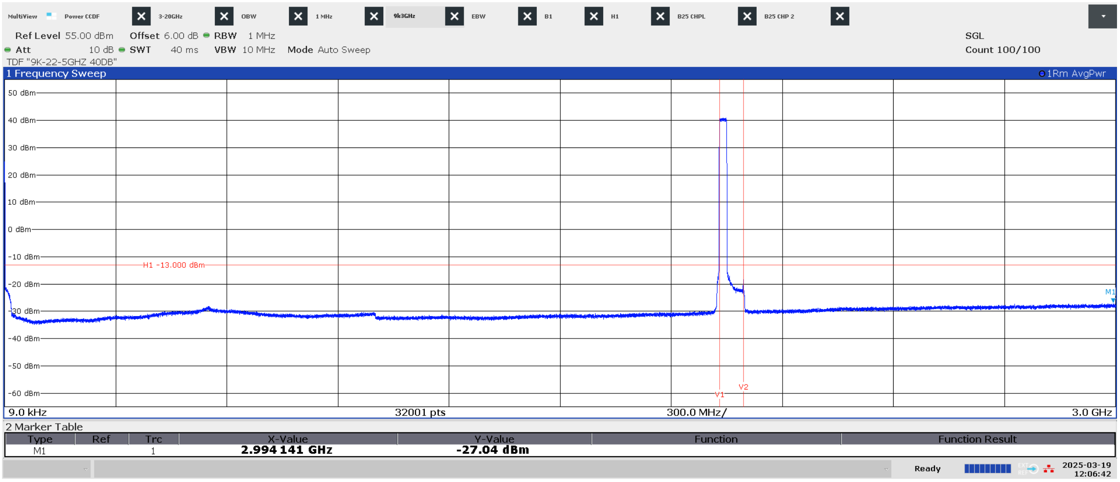
11:02:58 AM 03/19/2025

Diagram 3.36b NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+15NR}$, 3 – 20 GHz, Port A:



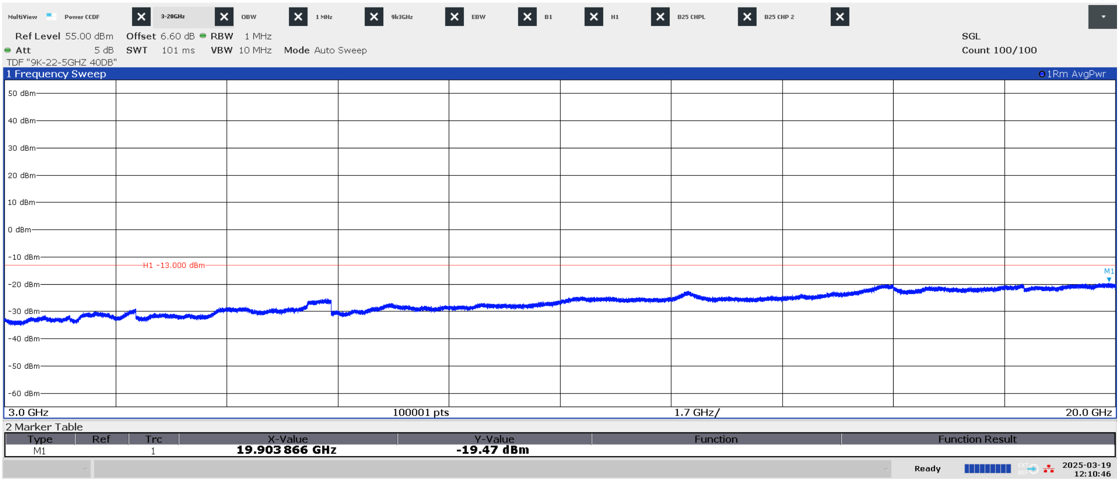
10:58:27 AM 03/19/2025

Diagram 3.37a NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+20NR}$, 9 kHz – 3 GHz, Port A



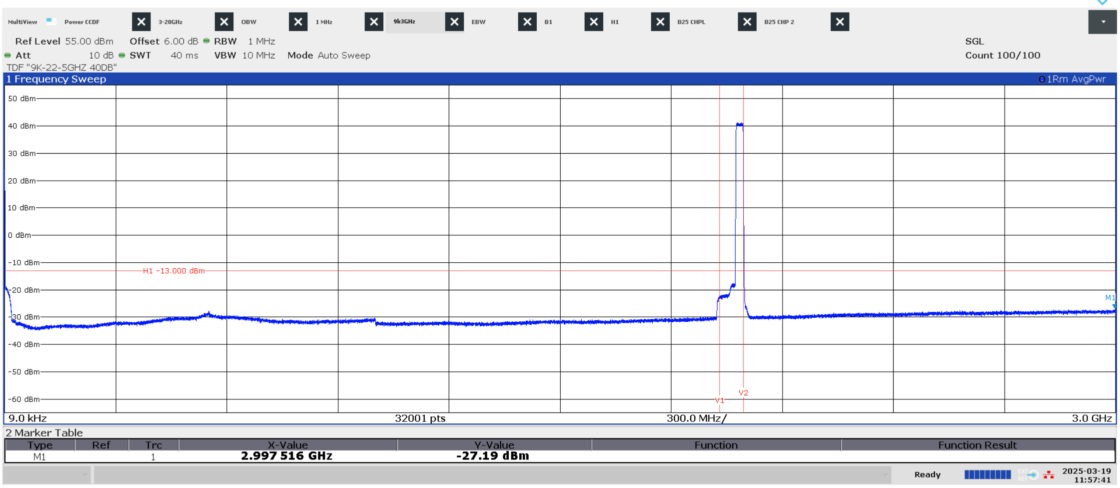
12:06:42 PM 03/19/2025

Diagram 3.37b NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+20NR}$, 3 – 20 GHz, Port A:



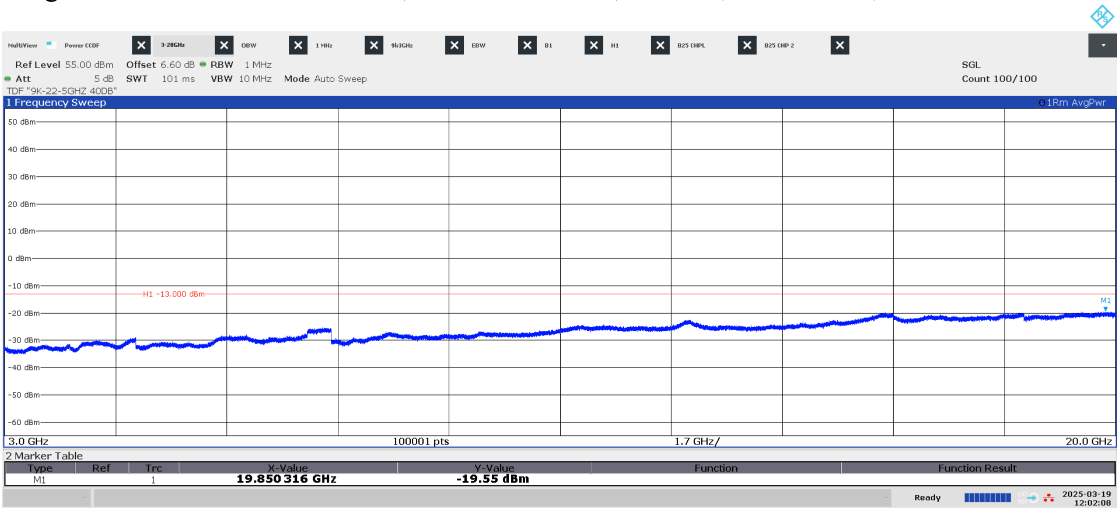
12:10:46 PM 03/19/2025

Diagram 3.38a NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+20NR}$, 9 kHz – 3 GHz, Port A



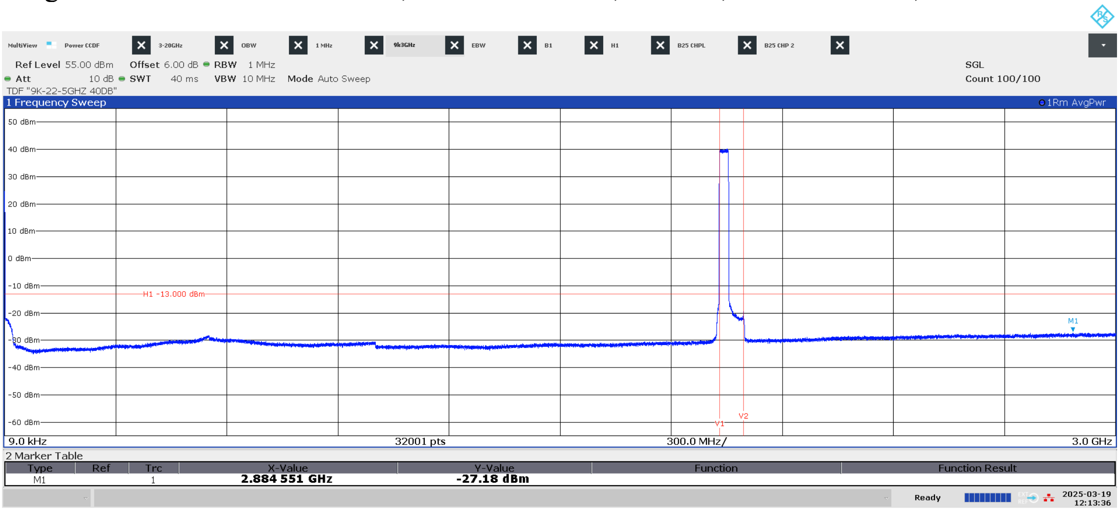
11:57:41 AM 03/19/2025

Diagram 3.38b NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+20NR}$, 3 – 20 GHz, Port A:



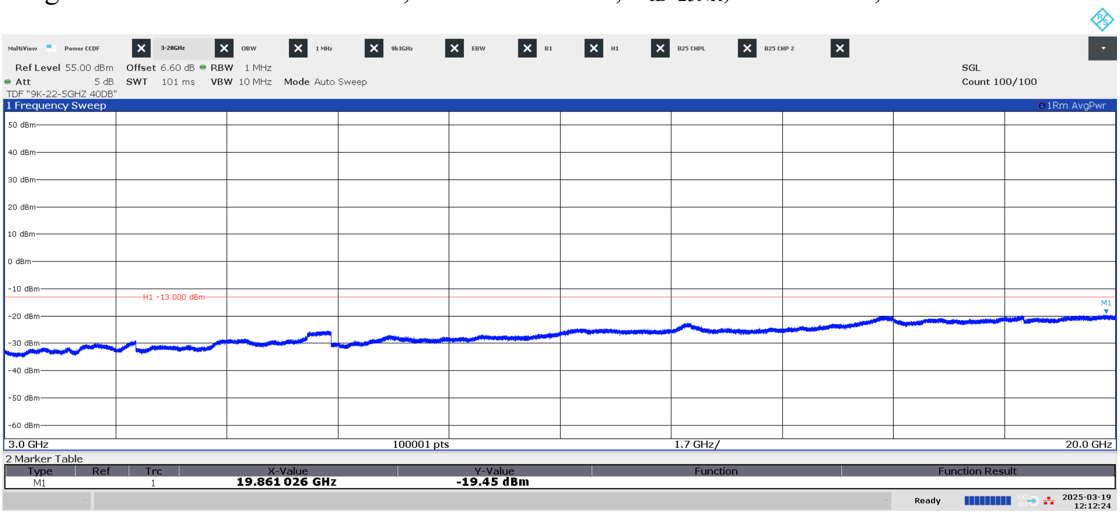
12:02:08 PM 03/19/2025

Diagram 3.39a NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+25NR}$, 9 kHz – 3 GHz, Port A



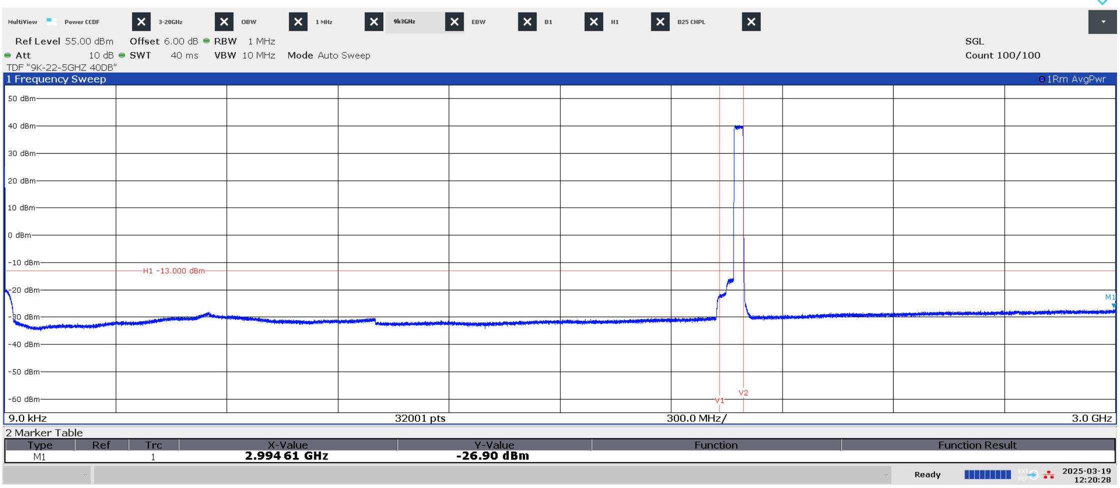
12:13:36 PM 03/19/2025

Diagram 3.39b NB IoT IB: N-TM, NR: FR1-TM1.1, $B_{IB+25NR}$, 3 – 20 GHz, Port A:



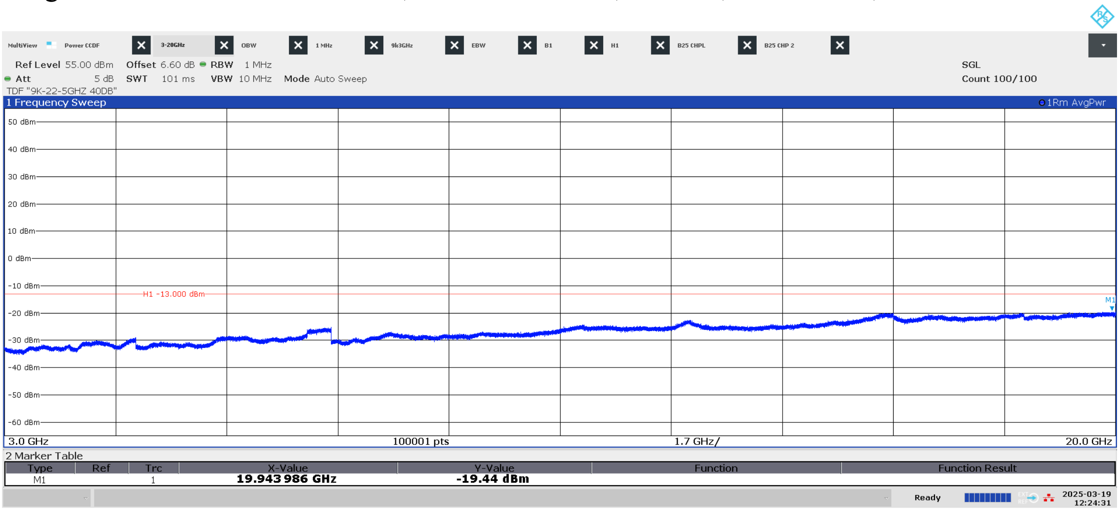
12:12:24 PM 03/19/2025

Diagram 3.40a NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+25NR}$, 9 kHz – 3 GHz, Port A



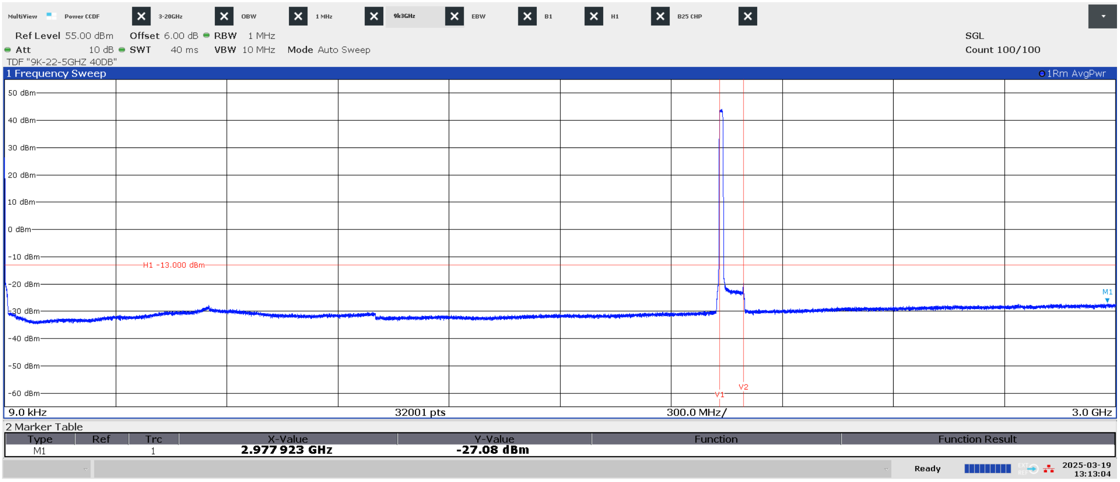
12:20:29 PM 03/19/2025

Diagram 3.40b NB IoT IB: N-TM, NR: FR1-TM1.1, $T_{IB+25NR}$, 3 – 20 GHz, Port A:



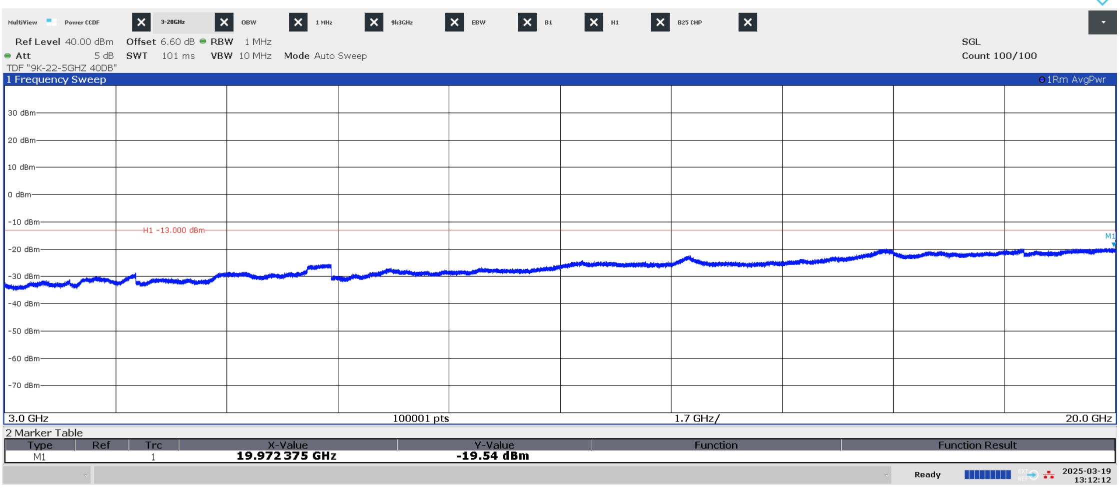
12:24:31 PM 03/19/2025

Diagram 3.41a: LTE and NR: FR1/E-TM1.1, BESS$_{10NR+LTE}$, 9 kHz – 3 GHz,, Port A:



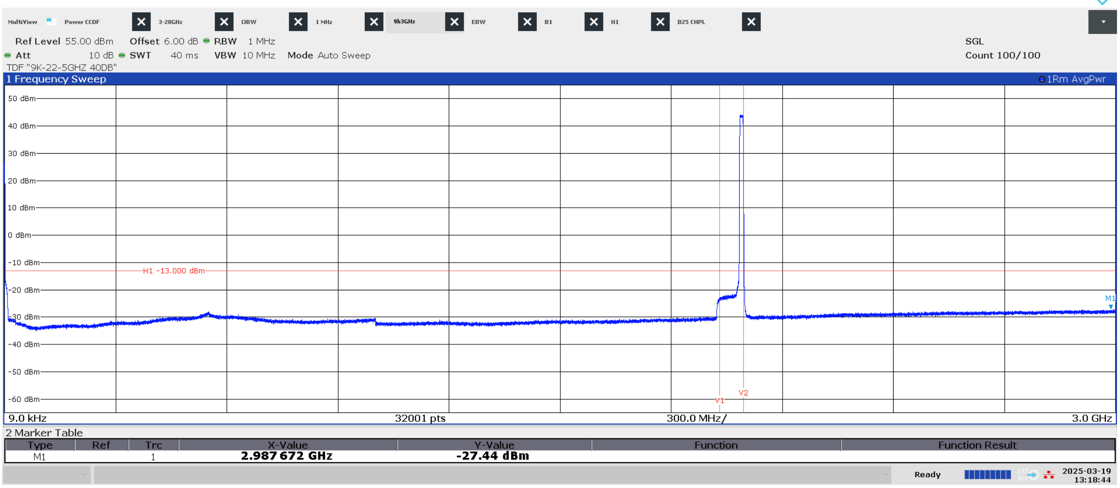
01:13:05 PM 03/19/2025

Diagram 3.41b LTE and NR: FR1/E-TM1.1, BESS$_{10NR+LTE}$, 3 – 20 GHz, Port A:



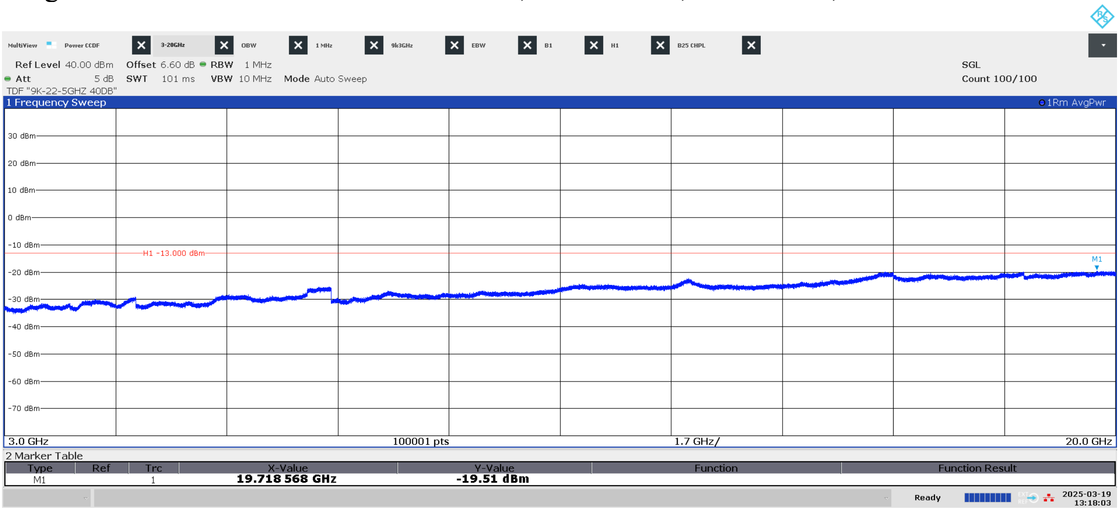
01:12:12 PM 03/19/2025

Diagram 3.42a: LTE and NR: FR1/E-TM1.1, $TESS_{10NR+LTE}$, 9 kHz – 3 GHz,, Port A:



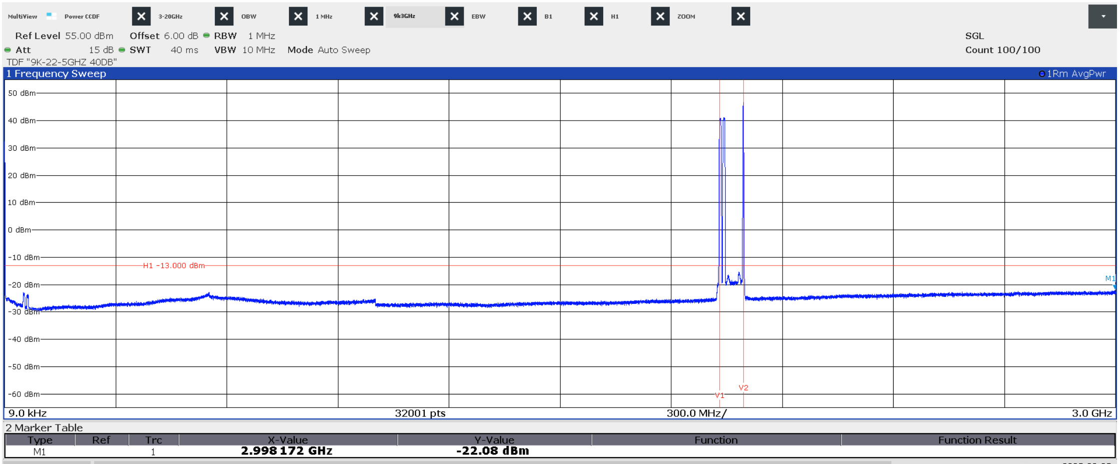
01:18:44 PM 03/19/2025

Diagram 3.42b LTE and NR: FR1/E-TM1.1, $TESS_{10NR+LTE}$, 3 – 20 GHz, Port A:



01:18:03 PM 03/19/2025

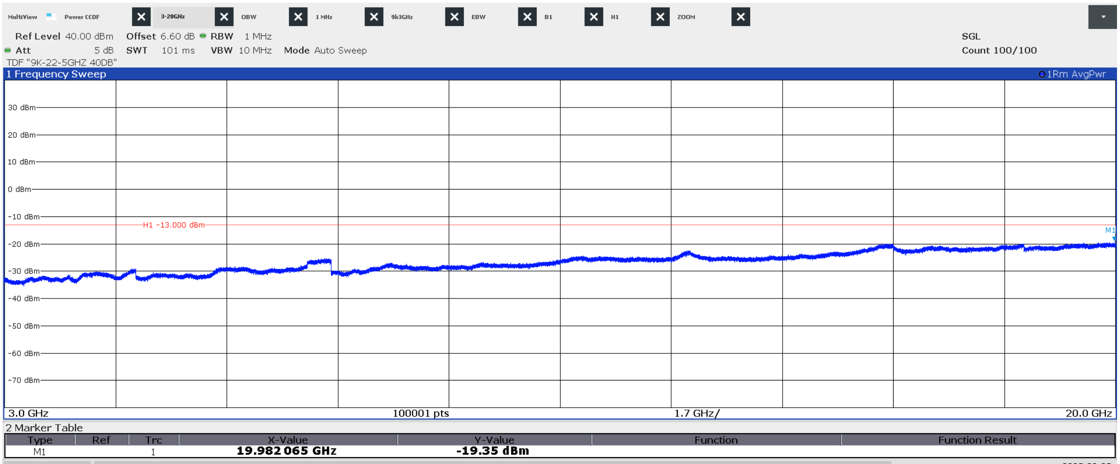
Diagram 3.43a: NR: FR1-TM1.1, NB IoT: N-TM, $B_{NR+IOT\ SA}$, 9 kHz – 3 GHz, Port A:



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.998 172 GHz	-22.08 dBm		

09:07:06 AM 03/25/2025

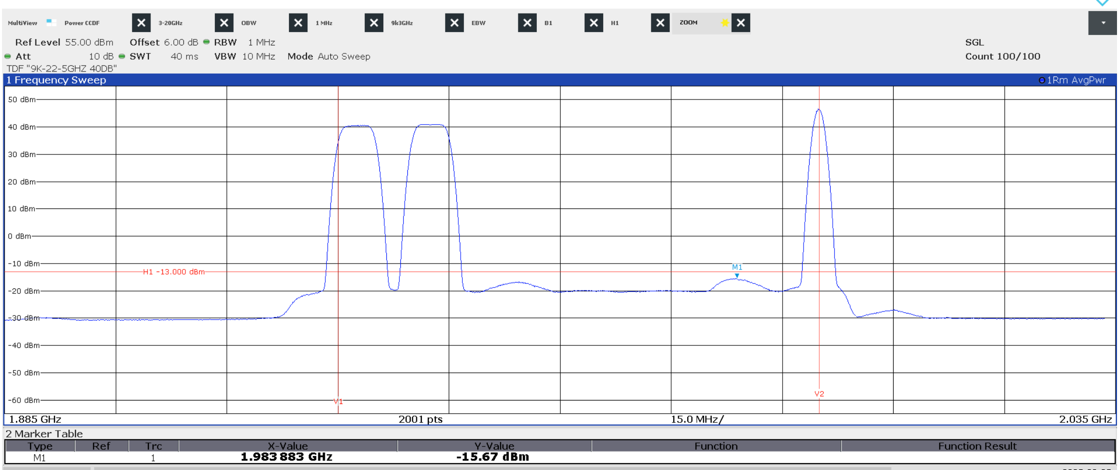
Diagram 3.43b: NR: FR1-TM1.1, NB IoT: N-TM, $B_{NR+IOT\ SA}$, 3 GHz- 20 GHz, Port A



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	19.982 065 GHz	-19.35 dBm		

09:08:40 AM 03/25/2025

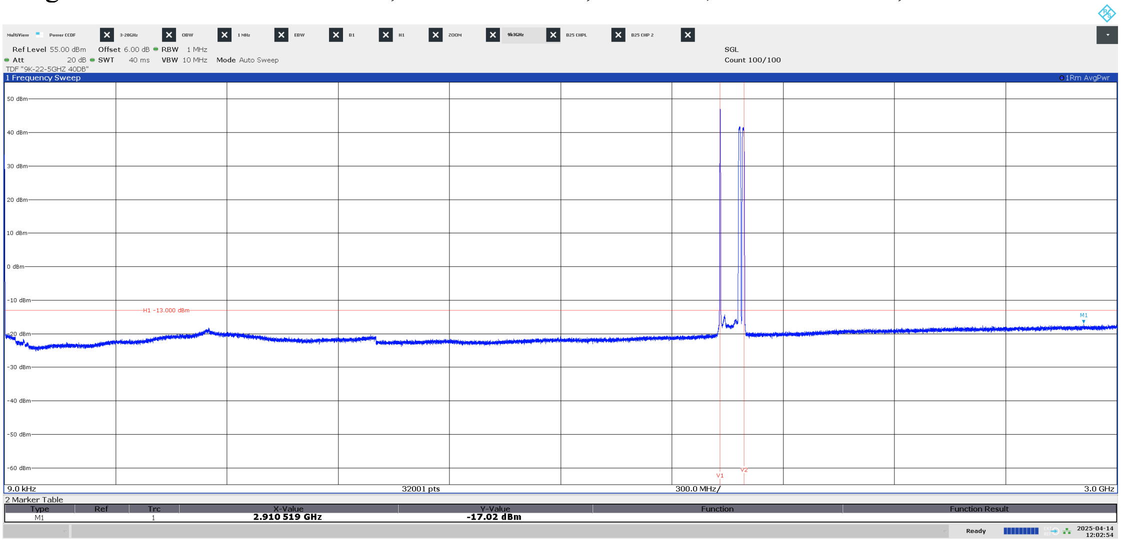
Diagram 3.43c: NR: FR1-TM1.1, NB IoT: N-TM, $B_{NR+IOT\ SA}$, Zoom, Port A



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	1.983 883 GHz	-15.67 dBm		

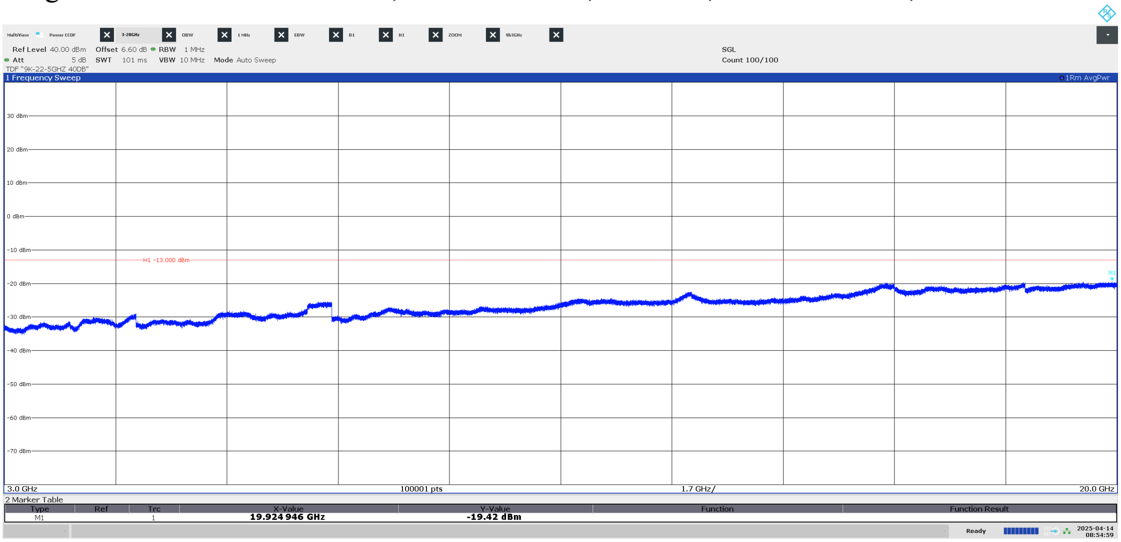
08:56:58 AM 03/25/2025

Diagram 3.44a: NR: FR1-TM1.1, NB IoT: N-TM, $T_{NR+IOT\ SA}$, 9 kHz – 3 GHz, Port A:



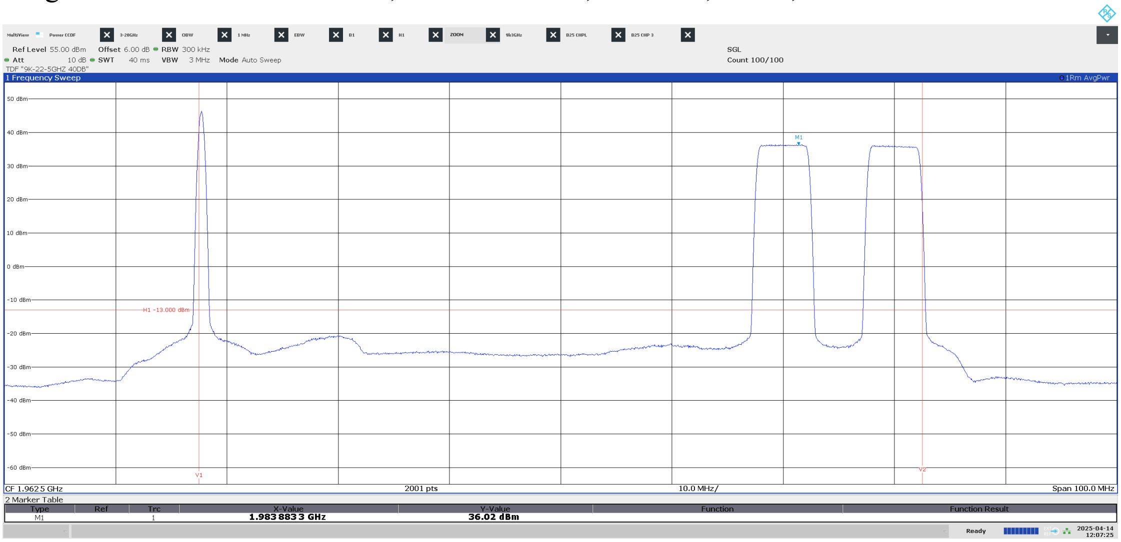
12:02:54 PM 04/14/2025

Diagram 3.44b: NR: FR1-TM1.1, NB IoT: N-TM, $T_{NR+IOT\ SA}$, 3 GHz- 20 GHz, Port A



08:55:00 AM 04/14/2025

Diagram 3.44c: NR: FR1-TM1.1, NB IoT: N-TM, $T_{NR+IOT\ SA}$, Zoom, Port A



12:07:25 PM 04/14/2025

Field strength of spurious radiation measurements according to CFR 47 §24.238 / RSS-133 5.6

Date	Temperature	Humidity
2025-03-20	22 °C ± 3 °C	31 % ± 5 %
2025-03-21	22 °C ± 3 °C	29 % ± 5 %

The test site conforms to the site validation criterion specified in ANSI C63.4.

The measurements were performed with both horizontal and vertical polarization of the antenna.

The antenna distance was 3 m in the frequency range 30 MHz – 20 GHz.

The EUT was placed 0.8 m above reference ground plane in frequency range 30 MHz – 1 GHz and 1.5 m above reference ground plane in frequency range 1 GHz – 20 GHz.

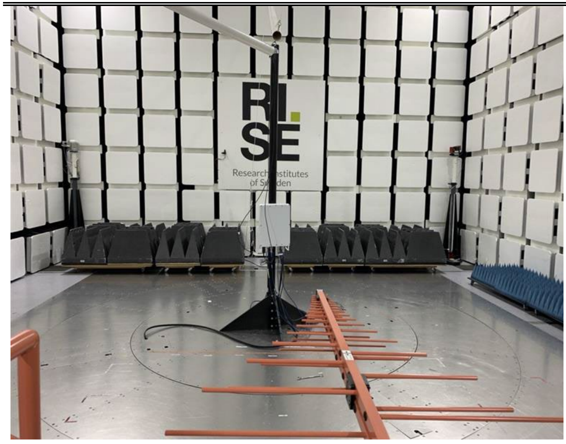
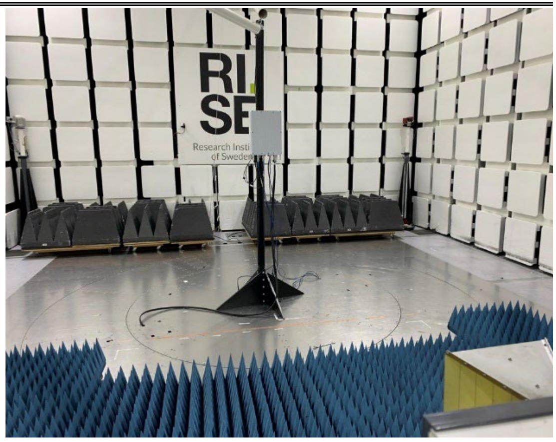
The measurement was performed with an RBW of 1 MHz.

A propagation loss in free space was calculated. The used formula was
$\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

1. A pre-measurement is performed with peak detector. For measurement < 1 GHz the test object was measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna height 1.5 m, 2.0 m and 2.5 m with elevation angle.
2. Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1- 4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to ANSI 63.26.

The test set-up during the spurious radiation measurements is shown in the pictures below:

Test setup 30-1000 MHz:	Test setup 1-20 GHz:
	

Measurement equipment

Item	Name	Inv.no
Semi Anechoic Chamber	TDK	503881
	NSA	BX90699
	SVSWR	BX90702
Spectrum Analyzer	Rohde & Schwarz ESW44	KWP18505
Software	Rohde & Schwarz Elektra	BX62351
RF cable	Huber & Suhner Eacon 4C	BX91490
RF Cable	Rosenberger UFB311A	503508
RF Cable	Rosenberger UFB311A	503509
Antenna, Bilog	Teseq CBL6143A	BX92331
Preamplifier	MicroComp Nordic MCN-JS42-00101800-28-10P	901545
HP filter	Wainwright WHKX1.0/18G-10SS	901373
Antenna, Horn	Emco 3115	502175
Antenna, Horn	Flann Standard gain horn, 18240-25	503900
Thermohygrometer	Testo 625	504188

Tested frequencies

Symbolic name:

Symbolic name:
B_{5L}
T_{5NR}
M_{5NR}
L_{10NR}
T_{10L}
B_{20L}
T_{40NR}
T_{GB+10L}
B_{IB+5NR}
$3B_{10L} + 2T_{10NR} + T_{15NR}$

Results

Representing worst case:

Multi RAT:
Symbolic name: $3B_{10L} + 2T_{10NR} + T_{15NR}$, Diagram 4.3a-d

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-20 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty: 3.1 dB

Limits

§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,
-13 dBm.

(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.

RSS-133 5.6 Unwanted emission limits

Unwanted emissions shall be measured in terms of average values while the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, –13 dBm, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 MHz bands immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth (OBW). Beyond these 1 MHz bands, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth may be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% of the OBW, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed –13 dBm.

Complies?	Yes

Diagram 4.1a: $3B_{10L} + 2T_{10NR} + T_{15NR}$, 30-1000 MHz

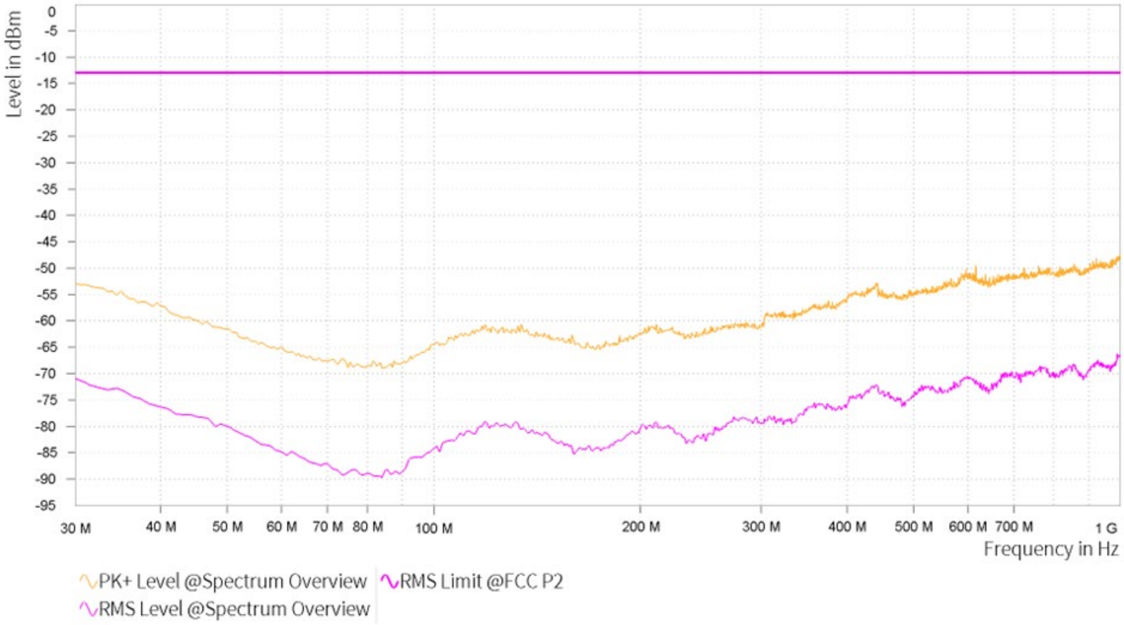


Diagram 4.1b: $3B_{10L} + 2T_{10NR} + T_{15NR}$, 1 - 3 GHz

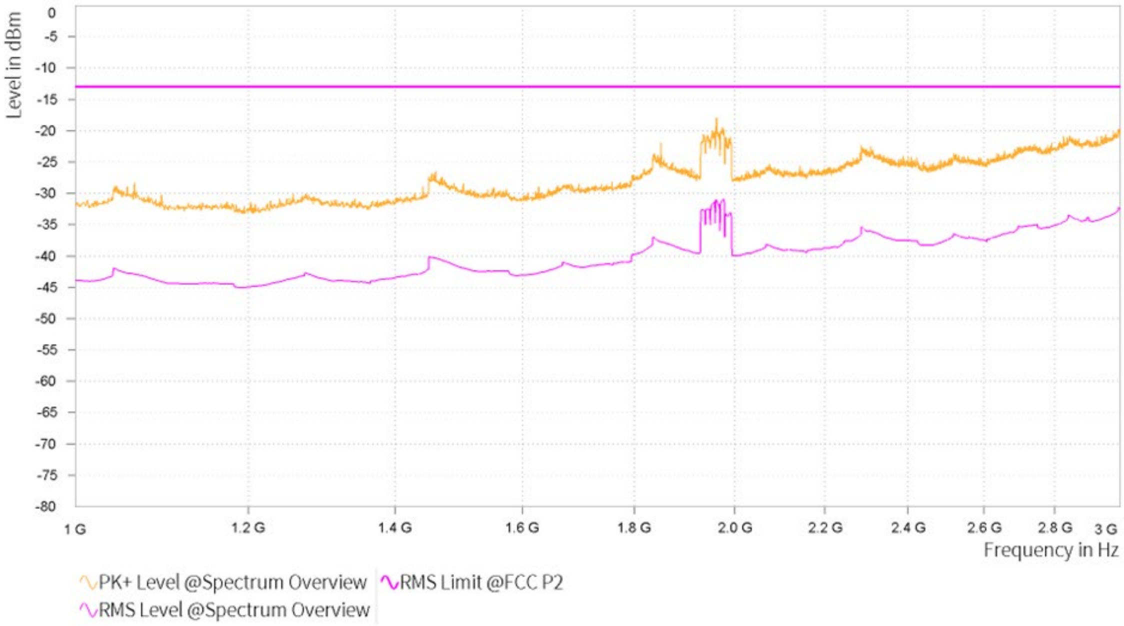


Diagram 4.1c: $3B_{10L} + 2T_{10NR} + T_{15NR}$, 3 – 12.75 GHz

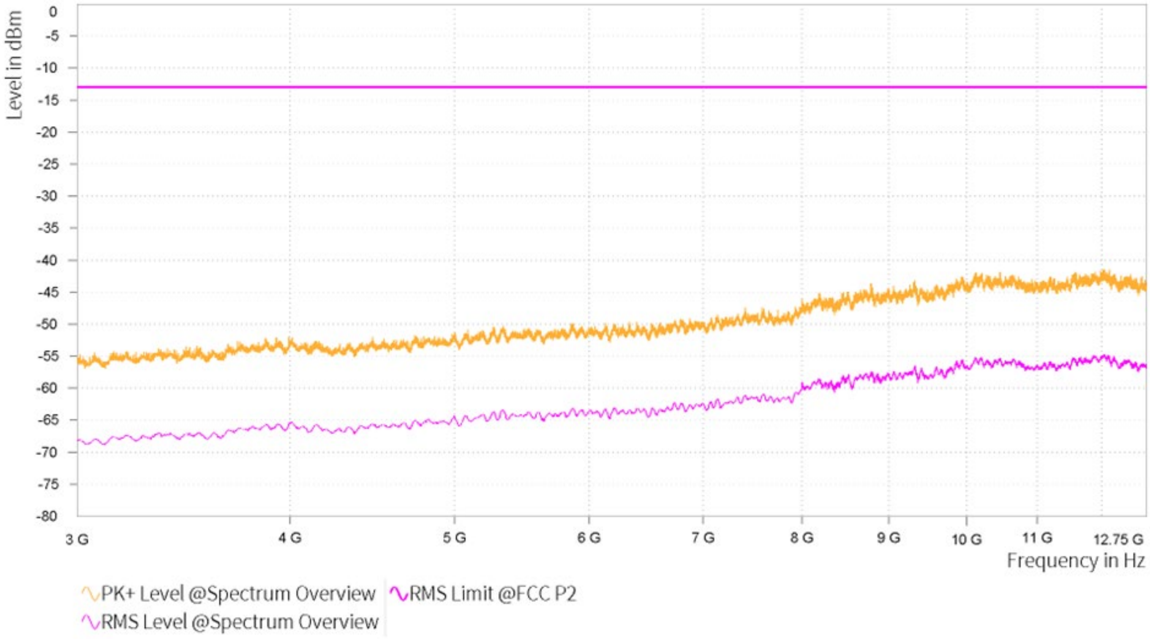
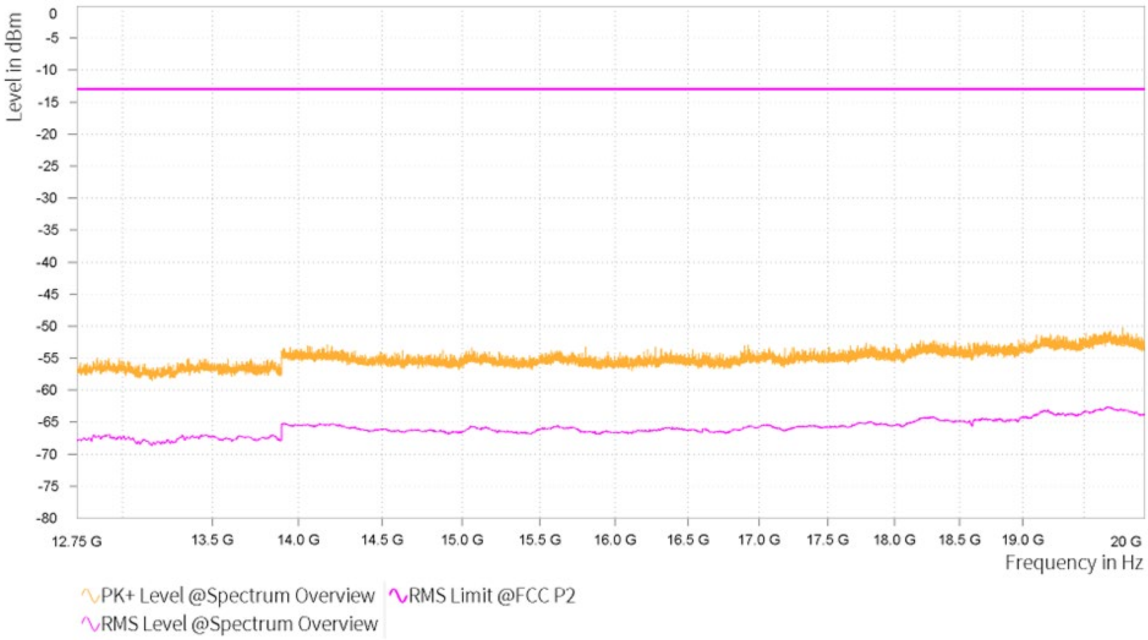


Diagram 4.1d: $3B_{10L} + 2T_{10NR} + T_{15NR}$, 12.75 - 20 GHz



Frequency stability measurements according to CFR 47 §24.235 and §2.1055/ RSS-133 5.4

Date	Temperature (test equipment)	Humidity (test equipment)
2025-03-25	23 °C ± °5	36 % ± 5 %
2025-03-26	23 °C ± °5	35 % ± 5 %
2025-03-27	23 °C ± °5	37 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.7.3. The test object was connected to a spectrum analyzer with the RMS detector activated.

Measurement equipment	RISE number
R&S FSQ40	504 143
R&S FSW 43	902 073
RF attenuator	902 282
Coaxial cable Sucoflex 102EA	BX50236
Coaxial cable Sucoflex 102EA	BX50237
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results LTE

Nominal transmitter frequency was 1962,5 MHz (M) with a bandwidth of 5 MHz. Rated output power level at connector RF A (maximum): 46 dBm.

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
40.8	+20	3
55.2	+20	4
48	+20	5
48	+30	3
48	+40	4
48	+50	4
48	+10	4
48	0	-6
48	-10	-9
48	-20	-8
48	-30	-9
Maximum freq. error (Hz)		9
Measurement uncertainty		< ± 1 x 10^{-7}

Results NR

Nominal transmitter frequency was 1962,5 MHz (M) with a bandwidth of 5 MHz. Rated output power level at connector RF A (maximum): 46 dBm.

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
40.8	+20	-4
55.2	+20	5
48	+20	4
48	+30	4
48	+40	4
48	+50	4
48	+10	4
48	0	3
48	-10	4
48	-20	5
48	-30	4
Maximum freq. error (Hz)		5
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Remark

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference to derive the TX frequency from.

Limits

§24.235 Frequency stability.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133 5.4 Frequency stability

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block or frequency block group when tested to the temperature and supply voltage variations specified in RSS-Gen.

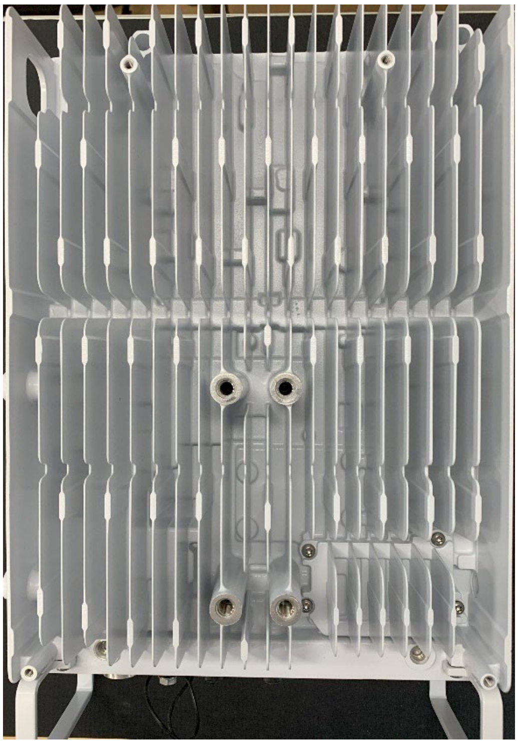
The frequency error results shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

Complies?	Yes

Photos of test object

Front side

Rear side



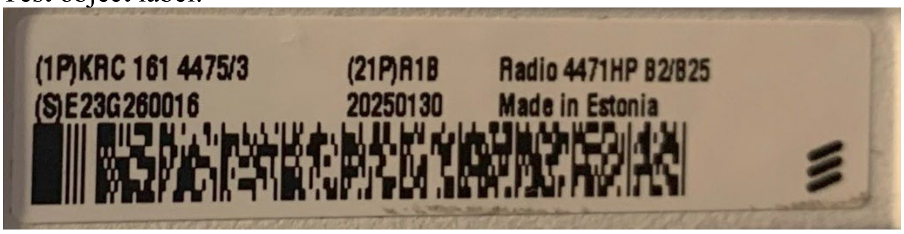
Left side

Right side

Bottom side

Top side

Test object label:



End of report.

Verification

Transaction 09222115557545310145

Document

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Main document
21 pages
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