REPORT

issued by an Accredited Testing Laboratory

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Date	Reference	Page
2020-10-27	2P06689	1 (93)

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Radio measurements on Radio 4480 44B2/B25 44B66A C equipment with FCC ID TA8AKRC161844 and IC 287AB-AS161844

Product name: Radio 4480 44B2/B25 44B66A C
Product number: KRC 161 844/1 and KRC 161 844/3

RISE Research Institutes of Sweden AB
Vehicles and Automation – EMC-IKT

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SWEDAC ACKREDITERING
Accred. No. 1002
Testing
ISO/IEC 17025

Summary

Standard Listed part of		Compliant
FCC CFR 47 part 24 and part 27/ RSS-133, RSS-139, RSS-Gen		
2.1046/ 6.4/ 6.5	RF power output	Yes
2.1049/ 4.6.1 Gen	Occupied bandwidth	Yes
2.1051/ 6.5/ 6.6	Band edge	Yes
2.1051/ 6.5/ 6.6	Spurious emission at antenna terminals	Yes
2.1053/ 6.5/ 6.6	Field strength of spurious radiation	Yes
2.1055/ 6.3/ 6.4	Frequency stability	Yes

Description of the test object

Equipment:	Radio 4480 44B2/B25 44B66A C Product number KRC 161 844/1 (with optional fan BKV106246/1) and KRC 161 844/3* FCC ID: TA8AKRC161844 IC: 287AB-AS161844 *KRC 161 844/3 is the NEBS version of the same product
HVIN:	AS161844
FVIN:	-
Hardware revision state:	R1A
Radio Access Technology, RAT and Frequency range:	Band 2 (B2): Single RAT: W, L, NB IoT SA, NR Multi RAT: G+W+NB IoT SA, G+L+NB IoT SA, W+L+NB IoT SA, NR+L+NB IoT SA, G+L+NR, W+L+NR TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz Band 25 (B25): Single RAT: W, L, NB IoT SA, NR Multi RAT: W+L+NB IoT SA, NR+L+NB IoT SA, W+L+NR TX: 1930 – 1995 MHz RX: 1850 – 1915 MHz Band 66 (B66): Single RAT: W, L, NB IoT SA, NR Multi RAT: W+L+NB IoT SA, NR+L+NB IoT SA, W+L+NR TX: 2110 – 2180 MHz RX: 1710 – 1780 MHz For WCDMA in B66 the frequencies are as follows: TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz
IBW:	B2: 60 MHz B25: 65 MHz B66: 70 MHz
Output power:	Maximum output power per carrier: NR: 5 MHz: 40 W 10, 15, 20 MHz: 60 W LTE: 1.4 and 3 MHz: 20 W (1.4 MHz and 3 MHz carriers are not supported in B66)

5 MHz: 40 W
10, 15, 20 MHz: 60 W

WCDMA: 40 W

GSM: 20 W (only available in B2)

NB IoT SA: 20 W

Maximum total output power/port: 80 W without optional fan
Maximum total output power/port: 100 W with optional fan
Maximum total output power/band and port: 60 W

Antenna ports B2/B25:	A-D: 4 TX / 4 RX ports
Antenna ports B66:	A-D: 4 TX / 4 RX ports
Antenna:	No dedicated antenna, handled during licensing.
RF configuration:	Single and multi-carrier, 1-12 carriers per port for both bands(6 in each band), Non-Contiguous Spectrum (NCS), Contiguous Spectrum (CS). NR: Max 6 carriers per Band and port, TX Diversity, 2x2 MIMO, 4x4 MIMO, Carrier Aggregation (CA) intra-band and inter-band supported. LTE: Max 6 carriers per Band and port, TX Diversity, 2x2 MIMO, 4x4 MIMO, Carrier Aggregation (CA) intra-band and inter-band supported. WCDMA: Max 6 carriers per band and port, 2x2 MIMO, 4x4 MIMO. GSM: Max 4 carriers per port, Single antenna, dual TX and Quad RX. NB IoT SA: Max 2 carriers per band and port. NB IoT Guard Band (GB): Max 1 Anchor PRB + 1 Non-Anchor PRB (For 10 MHz LTE carriers and wider). NB IoT Inband (IB): Max 1 Anchor PRB + 1 Non-Anchor PRB (For 3 MHz LTE carriers and wider).
Channel bandwidths:	NR: 5 MHz, 10 MHz 15 MHz and 20 MHz LTE: 1.4 MHz, 3MHz, 5 MHz, 10 MHz 15 MHz and 20 MHz WCDMA: 5 MHz GSM: 200 kHz NB IoT: 200 kHz

Sub-carrier spacing:	15 kHz	
Modulations:	NR: QPSK, 16QAM, 64QAM and 256QAM	
	LTE: QPSK, 16QAM, 64QAM and 256QAM	
	WCDMA: QPSK, 16QAM and 64QAM	
	GSM: GMSK, AQPSK and 8-PSK	
	NB IoT SA/ GB/ IB: QPSK, BPSK (BPSK is for up link only)	
Emission designators:	NR:	5 MHz: 4M50W7D 10 MHz: 9M29W7D 15 MHz: 14M2W7D 20 MHz: 18M9W7D 35 MHz: 33M9W7D (15+20 MHz, Carrier aggregation, only B66)
	LTE with and without NB IoT IB:	1.4 MHz BW:1M10W7D 3 MHz BW:2M69W7D 5 MHz BW: 4M48W7D 10 MHz BW: 8M97W7D 15 MHz BW: 13M5W7D 20 MHz BW: 17M9W7D 40 MHz BW: 37M8W7D (2x20 MHz, Carrier Aggregation)
	WCDMA:	4M20F9W
	GSM:	GMSK: 245KGXW AQPSK: 241KGXW 8PSK: 245KG7W
	NB IoT SA:	200KW7D
	LTE with NB IoT GB:	10 MHz BW: 9M39W7D 15 MHz BW: 14M0W7D 20 MHz BW: 18M4W7D
RF power Tolerance:	+0.6/ -2.5 dB	
CPRI Speed	Up to 10.1 Gbit/s	
Nominal supply voltage:	-48VDC	

The information above is supplied by the manufacturer.

Tested configuration: Single RAT: NR, WCDMA

Multi RAT: LTE+GSM+NB IoT SA, NR+LTE+ NB IoT SA, NR+LTE +WCDMA, LTE+GSM+WCDMA, LTE+WCDMA, NR+LTE, LTE+GSM+NB IoT SA+ WCDMA+NR

Purpose of test

The purpose of the tests is to verify compliance with the test object equipped with the optional fan and operating with the maximum total output power of 100 Watt per port to the performance characteristics specified in applicable parts of FCC CFR 47 part 24 and Part 27, ISED RSS-133, RSS-139 and RSS-Gen.

Operation modes during measurements

NR measurements were performed with the test object transmitting test models as defined in 3GPP TS 38.141-1. Test model NR-FR1-TM1.1 is used to represent QPSK, test model NR-FR1-TM3.2 to represent 16QAM, test model NR-FR1-TM3.1 to represent 64QAM modulation and test model NR-FR1-TM3.1a to represent 256QAM modulation. Test model NR-FR1-TM1.1 was used for all measurements representing worst case.

LTE measurements were performed with the test object transmitting test models as defined in 3GPP TS 36.141. Test model E-TM1.1 was used to represent QPSK, test model E-TM3.2 to represent 16QAM, test model E-TM3.1 to represent 64QAM modulation and E-TM3.1A to represent 256QAM modulation. Test model E-TM1.1 was used for all measurements representing worst case.

WCDMA measurements were performed with the test object transmitting the Test model 1 which are defined in 3GPP TS 25.141. Test model 1 (TM1) represent QPSK modulation. Test model 5 (TM5) includes the 16QAM modulation and Test model 6 (TM6) includes the 64QAM modulation. Test model TM1 was used for all measurements representing worst case.

GSM measurements were performed with the test object transmitting GMSK modulation representing worst case.

NB IoT SA (Stand Alone)
NB IoT SA measurements were performed with the test object transmitting test model N-TM representing QPSK as defined in 3GPP TS 36.141.

B2 and B25 overlap each other. They both have the same lower edge but the upper edge for B25 is 5 MHz higher. For measurements on middle configuration, the middle frequency for B25 was deemed representative for both bands. For band edge measurements on the top frequency configuration the measurements were repeated for the upper edge of both B2 and B25.

For all measurements the radio was configured with the total output power of 100 watts per port. For measurements noted with B25 max power configuration the Carrier(s) were configured with the maximum possible output power for the Carrier(s) in that band. The carrier in B66 was a 10 MHz NR carrier on 2145 MHz configured with the necessary output power to reach the maximum total power per port of 100 watts.

For measurements noted with B66 max power configuration, the Carrier(s) were configured with the maximum possible output power for the Carrier(s) in that band. The carrier in

B2/25 was a 10 MHz NR carrier on 1962.5 MHz configured with the necessary output power to reach the maximum total power per port of 100 watts.

Conducted measurements

The test object was supplied with -48 VDC by an external power supply. Additional connections are documented in the set-up drawings for conducted measurements.

The signal path of the measurement chain was calibrated with a network analyzer and the correction stored as a transducer factor in the measurement equipment.

Radiated measurements

The test object was powered with -48 VDC by an external power supply. Additional connections are documented in the set-up drawings for radiated measurements.

EUT Emission= SA reading + (CableLosses – Antenna gain(dBi) + TheoreticalPathloss + FilterLoss – LNAgain)

The correction factors are stored in R&S EMC 32 software as separate files and activated as applicable in the Hardware setup, for each measurement configuration. Emissions close or above the limit is verified with the substitution method where the EUT is replaced by a signal generator and an Antenna with known gain.

Test facility

The used semi-anechoic chamber is compliant with ANSI C63.4. RISE is an ISO 17025 accredited test facility for Electromagnetic Compatibility (EMC) and Radio testing. RISE is a Recognized Lab under FCC and ISED (registration No. 3482A) rules for the scope of standards used in this test report.

References

Measurements were done according to relevant parts of the following standards:
ANSI C63.4-2014+ C63.4a-2017
ANSI C63.5-2017
ANSI C63.26-2015
CFR 47 part 2, March 2020
CFR 47 part 24, March 2020
CFR 47 part 27, March 2020
KDB 484596 D01 Referencing Test Data v01
KDB 971168 D03 IM Emission Repeater Amp v01
3GPP TS 25.141, version 15.3.0
3GPP TS 36.141, version 15.3.0
3GPP TS 38.141-1, version 15.4.0
RSS-Gen Issue 5 Amendment 1
RSS-133 Issue 6 Amendment 1
RSS-139 Issue 3

Measurement equipment

	Calibration Due	RISE number
Test site Tesla	2022-12	503 881
Test site Marconi	-	15:121
R&S ESU 40	2021-07	901 385
R&S FSQ 40	2021-07	504 143
R&S FSW 43	2021-07	902 073
Control computer with R&S software EMC32 version 10.20.01	-	BX62351
Directional coupler	2021-02	901 496
RF attenuator	2021-02	902 282
High pass filter 3-27 GHz	2021-02	901 502
High pass filter 3-27 GHz	2021-02	BX40074
Coaxial cable Megaphase	2021-02	BX50191
Coaxial cable Sucoflex 102EA	2021-02	BX50236
Coaxial cable Sucoflex 102EA	2021-02	BX50237
Coaxial cable, Tesla emission	2021-06	BX91490
Coaxial cable	2021-09	503 508
Coaxial cable	2021-09	503 509
Teseq BiConiLog Antenna CBL6143A	2022-09	BX92331
EMCO Horn Antenna 3115	2021-07	502 175
Flann Standard Gain Horn 20240-20	-	BX92412
Miteq, Low Noise Amplifier 18-40 GHz	2021-01	503 278
Coaxial cable	2021-02	503 697
EMCO Horn Antenna 3116	2021-07	503 279
µComp Nordic, Low Noise Amplifier	2021-01	901 545
Temperature and humidity meter, Testo 635	2021-06	504 203
Temperature and humidity meter, Testo 625	2021-06	504 188

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered: 2020-08-26.

Manufacturer’s representative

Mikael Jansson, Ericsson AB.

Test engineers

Tomas Isbring, Andreas Björnqvist and Karl Flysjö for radiated tests, RISE
Tomas Lennhager and Karl Flysjö for conducted tests, RISE.

Test participant(-s)

None.

Test frequencies used for conducted measurements

B25 NR:

Frequency [MHz]	Symbolic name	Comment
1935.0	B_{10NR}	TX bottom frequency, 47.8 dBm output power
1962.5	M_{5NR}	TX middle frequency, 46 dBm output power
1962.5	M_{10NR}	TX middle frequency, 47.8 dBm output power
1962.5	M_{15NR}	TX middle frequency, 47.8 dBm output power
1962.5	M_{20NR}	TX middle frequency, 47.8 dBm output power
1990.0	T_{10NR}	TX top frequency, 47.8 dBm output power

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B2 NR:

Frequency [MHz]	Symbolic name	Comment
1985.0	T_{10NR}	TX top frequency, 47.8 dBm output power

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 NR:

Frequency [MHz]	Symbolic name	Comment
2115.0	B_{10NR}	TX bottom frequency, 47.8 dBm output power
2145.0	M_{5NR}	TX middle frequency, 46 dBm output power
2145.0	M_{10NR}	TX middle frequency, 47.8 dBm output power
2145.0	M_{15NR}	TX middle frequency, 47.8 dBm output power
2145.0	M_{20NR}	TX middle frequency, 47.8 dBm output power
2175.0	T_{10NR}	TX top frequency, 47.8 dBm output power

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B25 LTE:

Frequency [MHz]	Symbolic name	Comment
1935.0	B_{10L}	TX bottom frequency, 47.8 dBm output power
1962.5	$M_{1.4L}$	TX middle frequency, 43 dBm output power
1962.5	M_{3L}	TX middle frequency, 43 dBm output power
1962.5	M_{5L}	TX middle frequency, 46 dBm output power
1962.5	M_{10L}	TX middle frequency, 47.8 dBm output power
1962.5	M_{15L}	TX middle frequency, 47.8 dBm output power
1962.5	M_{20L}	TX middle frequency, 47.8 dBm output power
1990.0	T_{10L}	TX top frequency, 47.8 dBm output power

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 LTE:

Frequency [MHz]	Symbolic name	Comment
2115.0	B_{10L}	TX bottom frequency, 47.8 dBm output power
2145.0	M_{5L}	TX middle frequency, 46 dBm output power
2145.0	M_{10L}	TX middle frequency, 47.8 dBm output power
2145.0	M_{15L}	TX middle frequency, 47.8 dBm output power
2145.0	M_{20L}	TX middle frequency, 47.8 dBm output power
2175.0	T_{10L}	TX top frequency, 47.8 dBm output power

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B25 WCDMA:

Frequency [MHz]	Symbolic name	Comment
1962.4	M_W	TX bottom frequency, 46 dBm output power

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 WCDMA:

Frequency [MHz]	Symbolic name	Comment
2132.6	M_W	TX bottom frequency, 46 dBm output power

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B25 NB IoT SA:

Frequency [MHz]	Symbolic name	Comment
1962.5	M_{IoT}	TX bottom frequency, 43 dBm output power

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 NB IoT SA:

Frequency [MHz]	Symbolic name	Comment
2145.0	M_{IoT}	TX bottom frequency, 43 dBm output power

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B2 GSM:

Frequency [MHz]	Symbolic name	Comment
G=1960.0 L=1945.0	M_{G+L}	TX middle Frequency for GSM. LTE carrier with 10 MHz carrier bandwidth. 43 dBm output power for the GSM carrier and 46 dBm output power for the LTE carrier (47.8 dBm total output power).

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B2 GSM+NB IoT SA+LTE:

Frequency [MHz]	Symbolic name	Comment
G=1930.4 IoT=1931.0 L=1987.5	$Bim_{G+IoT+L}$	TX constellation for Bim with a LTE carrier with 5 MHz carrier bandwidth, a NB IoT SA carrier and a GSM carrier. 43 dBm output power per carrier (47.8 dBm total output power).
L=1932.5 IoT=1989.0 G=1989.6	$Tim_{G+IoT+L}$	TX constellation for Tim with a LTE carrier with 5 MHz carrier bandwidth, a NB IoT SA carrier and a GSM carrier. 43 dBm output power per carrier (47.8 dBm total output power).
L_1=1932.5 G_1=1950.2 IoT_1=1950.8 G_2=1969.2 IoT_2=1969.8 L_2=1987.5	$Max_{G+IoT+L}$	TX constellation with two LTE 5 MHz bandwidth carriers, two GSM carriers and two NB IoT SA carriers. 40 dBm output power per carrier (47.8 dBm total output power).

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B25 NR+LTE+NB IoT SA:

Frequency [MHz]	Symbolic name	Comment
IoT=1930.2 L=1949.3 NR=1992.5	$Bim_{NR+L+IoT}$	TX constellation for Bim, NR carrier with 5 MHz BW, LTE carrier with 1.4 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR=1932.5 L=1975.7 IoT=1994.8	$Tim_{NR+L+IoT}$	TX constellation for Tim, NR carrier with 5 MHz BW, LTE carrier with 1.4 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR_1=1932.5 L_1=1953.2 IoT_1=1960.0 L_2=1965.0 IoT_2=1971.8 NR_2=1992.5	$Max_{NR+L+IoT}$	TX max carriers constellation, NR carrier with 5 MHz BW, LTE carriers with 1.4 MHz BW, 40 dBm output power per carrier (47.8 dBm total output power).

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 NR+LTE+NB IoT SA:

Frequency [MHz]	Symbolic name	Comment
IoT=2110.2 L=2127.5 NR=2177.5	$Bim_{NR+L+IoT}$	TX constellation for Bim, NR carrier with 5 MHz BW, LTE carrier with 5 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR=2112.5 L=2162.5 IoT=2179.8	$Tim_{NR+L+IoT}$	TX constellation for Tim, NR carrier with 5 MHz BW, LTE carrier with 5 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR_1=2112.5 L_1=2133.2 IoT_1=2140.0 L_2=2145.0 IoT_2=2151.8 NR_2=2177.5	$Max_{NR+L+IoT}$	TX max carriers constellation, NR carriers with 5 MHz BW, LTE carriers with 5 MHz BW, 40 dBm output power per carrier (47.8 dBm total output power).

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B25 NR+LTE+WCDMA

Frequency [MHz]	Symbolic name	Comment
NR=1932.5 L=1947.3 W=1992.6	Bim_{NR+L+W}	TX constellation for Bim, NR carrier with 5 MHz BW, LTE carrier with 1.4 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
W=1932.4 L=1975.7 NR=1992.5	Tim_{NR+L+W}	TX constellation for Tim, NR carrier with 5 MHz BW, LTE carrier with 1.4 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR_1=1932.5 W_1=1940.0 L_1=1953.2 L_2=1971.8 W_2=1985.0 NR_2=1992.5	Max_{NR+L+W}	TX max carrier constellation, NR carriers with 5 MHz BW, LTE carriers with 1.4 MHz BW, 40 dBm output power per carrier (47.8 dBm total output power).

The RX frequencies were configured 80MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

B66 NR+LTE+WCDMA

Frequency [MHz]	Symbolic name	Comment
NR=2112.5 W=2127.6 L=2177.5	Bim_{NR+L+W}	TX constellation for Bim, NR carrier with 5 MHz BW, LTE carrier with 5 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
W=2112.4 L=2162.5 NR=2177.5	Tim_{NR+L+W}	TX constellation for Tim, NR carrier with 5 MHz BW, LTE carrier with 5 MHz BW, 43 dBm output power per carrier (47.8 dBm total output power).
NR_1=2112.5 W_1=2120.0 L_1=2132.5 W_2=2150.0 L_2=2165.0 NR_2=2177.5	Max_{NR+L+W}	TX max carriers constellation, NR carriers with 5 MHz BW, LTE carriers with 1.4 MHz BW, 40 dBm output power per carrier (47.8 dBm total output power).

The RX frequencies were configured 400MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

Test frequencies used for radiated measurements

B2/25 and B66

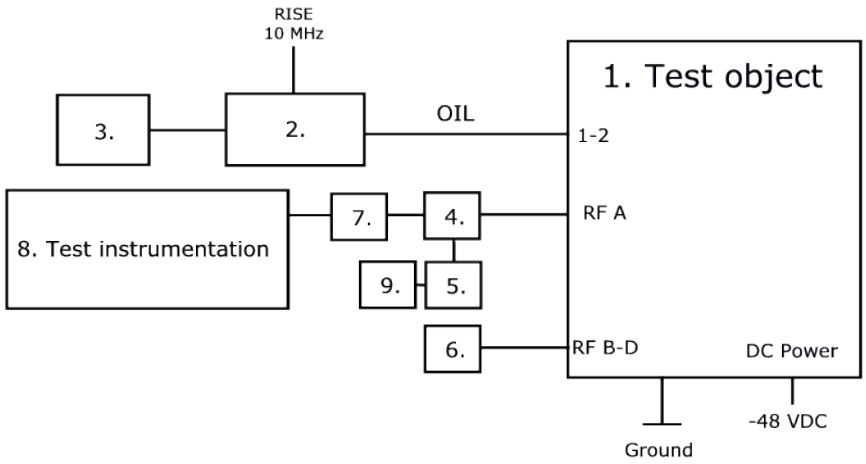
Frequency [MHz]	Symbolic name	Comment
L=1987.5 G=1960.0 W=2177.6	MT_{L+G+W}	B2: LTE carrier top with 5 MHz BW and 46 dBm output power, GSM carrier mid with 43 dBm output power. B66: WCDMA carrier top with 46 dBm output power
W_1=1932.5 W_2=1992.5 W_3=2177.5	BT_W	B25: WCDMA carrier bot with 46 dBm output power, WCDMA carrier top with 43 dBm output power. B66: WCDMA carrier top with 46 dBm output power
L_1=1987.5 W_1=1992.6 L_2=2172.5 W_2=2177.6	MT_{L+W}	B25: LTE carrier top with 5 MHz BW, WCDMA carrier top. B66: LTE carrier top with 5 MHz BW, WCDMA carrier top. Each carrier was configured with 44 dBm output power.
L=1987.5 NR_1=1992.5 NR_2=2177.5	T_{NR+L}	B25:LTE carrier top with 1.4 MHz BW and 43 dBm output power, NR carrier top with 5 MHz BW and 46 dBm output power. B66: NR carrier top with 5 MHz BW and 46 dBm output power.
NR_1=1932.5 L=1937.5 NR_2=2112.5	B_{NR+L}	B25: NR carrier bot with 5 MHz BW and 46 dBm output power, LTE carrier bot with 1.4 MHz BW and 43 dBm output power. B66: NR carrier top with 5 MHz BW and 46 dBm output power.
G=1945.0 L=1952.5 IoT=1960.0 W=1937.5 NR=2112.5	BMT_{MAX}	B2: GSM carrier mid, LTE carrier mid with 1.4 MHz BW, NB IoT SA carrier mid. B66: WCDMA carrier bot, NR carrier top with 5 MHz BW. Each carrier was configured with 43 dBm output power.

For B2/25 the RX frequency was configured 80 MHz below the corresponding TX frequency according to the applicable duplex offset for the operating band.

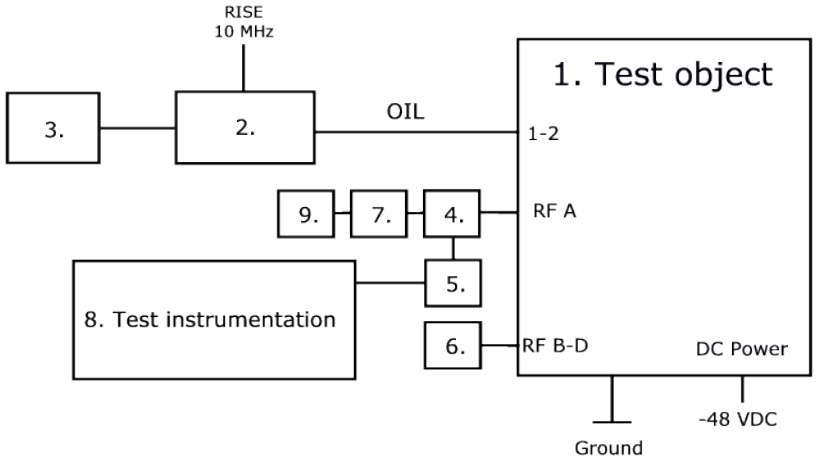
For B66 the RX frequencies were configured 400 MHz below the corresponding TX frequency according to the applicable duplex offset for the operating band.

Test setup: conducted measurements

Setup for measurements from 9 kHz to 3 GHz.



Setup for measurements from 3 GHz to 22GHz.



Test object:

1.	Radio 4480 44B2/B25 44B66A C, KRC 161 844/1, rev. R1A, s/n: E23B490698 With optional fan. With Radio Software: CXP 901 3268/15, rev. R81JH09 FCC ID: TA8AKRC161844, IC: 287AB-AS161844

Associated equipment:

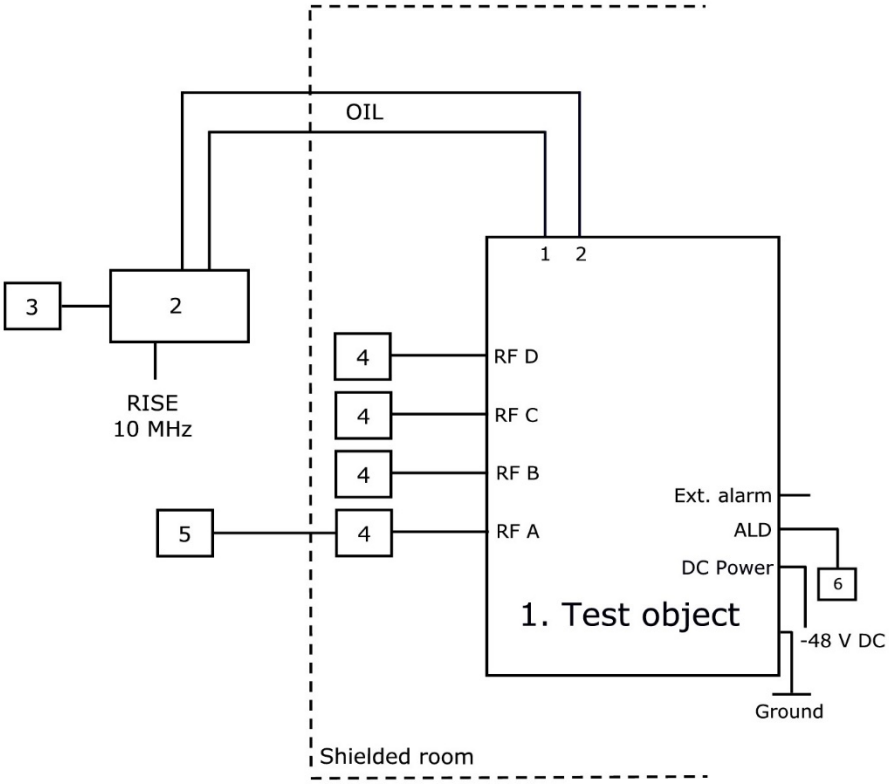
2.	Testing Equipment: CT10, LPC 102 487/1, rev. R1C, s/n: T01F265039, BAMS – 1001908401 with software CXC 173 5312/29, rev. R1A02

Functional test equipment:

3.	Computer, HP ZBook 15u G3, BAMS - 1001835579
4.	Directional Coupler: RISE-number: 901 496
5.	High pass filter 3-27 GHz: RISE-Number: 901 502
6.	50 ohm terminator on each port

7.	RF Attenuator: RISE number: 902 282
8.	RISE Test Instrumentation according to measurement equipment list for each test. The signal analyzer was connected to the RISE 10 MHz reference standard during all measurements.
9.	50 ohm SMA terminator.

Test setup: radiated measurements



1.	Radio 4480 44B2/B25 44B66A C, KRC 161 844/1, rev. R1A, s/n: E23B490698 With optional fan. With Radio Software: CXP 901 3268/15, rev. R81JH09 FCC ID: TA8AKRC161844, IC: 287AB-AS161844

Associated equipment:

2.	Testing Equipment: CT10, LPC 102 487/1, rev. R1C, s/n: T01F265031, BAMS – 1000797753 with software CXC 173 5312/25, rev. R1A07

Functional test equipment:

3.	HP EliteBook 8560w, BAMS – 1001236854
4.	Attenuator/ Terminator
5.	R&S ESIB 26, SP no: 503 292 for supervision purpose only
6.	Remote Control Unit, ANDREW Model: ATM200-A20, Serial: CN10151085133

Interfaces:

Power input configuration DC: -48 VDC	Power
RF A-D, 4.3-10 connector, combined TX/RX	Antenna
1, Optical Interface Link, single mode opto fibre	Signal
2, Optical Interface Link, single mode opto fibre	Signal
ALD Control, shielded multi-wire	Signal
EXT Alarm, shielded multi-wire	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §24.232 and §27.50/ RSS-133 6.4, RSS-139 5.5 conducted

Date	Temperature	Humidity
2020-08-26	24 °C ± 3 °C	38 % ± 5 %
2020-08-27	25 °C ± 3 °C	25 % ± 5 %
2020-10-16	23 °C ± 3 °C	31 % ± 5 %
2020-10-20	22 °C ± 3 °C	38 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.2.3.4. The test object was connected to a signal analyser measuring peak and RMS output power in CDF mode. A resolution bandwidth of 50 MHz was used if not otherwise specified.

Measurement equipment	RISE number
R&S FSQ 40	504 143
Directional coupler	901 496
RF attenuator	902 282
Coaxial cable Megaphase	BX50191
Coaxial cable Sucoflex 102EA	BX50237
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results NR

B25 max power configuration:

Single carrier NR-FR1-TM1.1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{5NR}	45.57/8.85

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Rated output power level at each RF port 1x 47.8 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{10NR}	47.41/7.40
M_{15NR}	47.38/7.47
M_{20NR}	47.32/7.44

Note: The PAR value is the 0.1 % Peak to Average Ratio.

B66 max power configuration:

Single carrier NR-FR1-TM1.1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{5NR}	45.56/8.85

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Rated output power level at each RF port 1x 47.8 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{10NR}	47.30/7.40
M_{15NR}	47.31/7.47
M_{20NR}	47.31/7.47

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Results LTE

B25 max power configuration:

Single carrier E-TM1.1

Rated output power level at each RF port 1x 43 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
$M_{1.4L}$	42.63/8.40
M_{3L}	42.64/8.49

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{5L}	45.84/8.40

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Rated output power level at each RF port 1x 47.8 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{10L}	47.50/7.31
M_{15L}	47.52/7.31
M_{20L}	47.53/7.31

Note: The PAR value is the 0.1 % Peak to Average Ratio.

B66 max power configuration:

Single carrier E-TM1.1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{5L}	45.70/8.37

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Rated output power level at each RF port 1x 47.8 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{10L}	47.45/7.28
M_{15L}	47.45/7.31
M_{20L}	47.44/7.31

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Results WCDMA

B25 max power configuration:

Single carrier TM1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_W	45.75/8.39

Note: The PAR value is the 0.1 % Peak to Average Ratio.

B66 max power configuration:

Single carrier TM1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_W	45.67/7.37

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Results NB IoT SA

CCDF resolution bandwidth of 5 MHz was used for NB IoT SA.

Due to a 86 % duty cycle of the IoT carrier, 0.65 dBm was added to the measured value of the NB IoT Stand Alone carriers according to ANSI C63.26, 5.2.4.4.2, j.

B25 max power configuration:

Single carrier N-TM

Rated output power level at each RF port 1x 43 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{IoT}	42.80/5.03

Note: The PAR value is the 0.1 % Peak to Average Ratio.

B66 max power configuration:

Single carrier N-TM

Rated output power level at each RF port 1x 43 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{IoT}	42.77/5.00

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Results GSM

CCDF resolution bandwidth of 5 MHz was used for GSM.

B2 max power configuration:

Multi RAT: GSM: GMSK, LTE: E-TM1.1

Rated output power level at each RF port 1x 43 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]
Symbolic name	Port RF A
M_{G+L}	42.32/0.32

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Remark

ERP/EIRP compliance is addressed at the time of licensing, as required by the responsible FCC/ISED Bureau(s). Licensee's are required to take into account maximum antenna gain used in combination with above power settings to prevent the radiated output power to exceed the limits.

Limits

§24.232 and RSS-133 6.4/SRSP-510 5.1.1
The maximum output power may not exceed 3280 W/MHz (EIRP).
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

§27.50 (d) an RSS-139 6.5/SRSP-513 5.1.1
The maximum output power may not exceed 3280 W/MHz (EIRP).
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Complies?	Yes

Occupied bandwidth measurements according to CFR47 2.1049/ RSS-Gen 4.6.1

Date	Temperature	Humidity
2020-10-16	23 °C ± 3 °C	31 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.4.4. The output was connected to a signal analyzer with the Peak detector activated in max hold.

Measurement equipment	RISE number
R&S FSQ 40	504 143
Directional coupler	901 496
RF attenuator	902 282
Coaxial cable Megaphase	BX50191
Coaxial cable Sucoflex 102EA	BX50237
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 2.6 %

Results NR

B25 max power configuration:

Single carrier NR-FR1-TM1.1

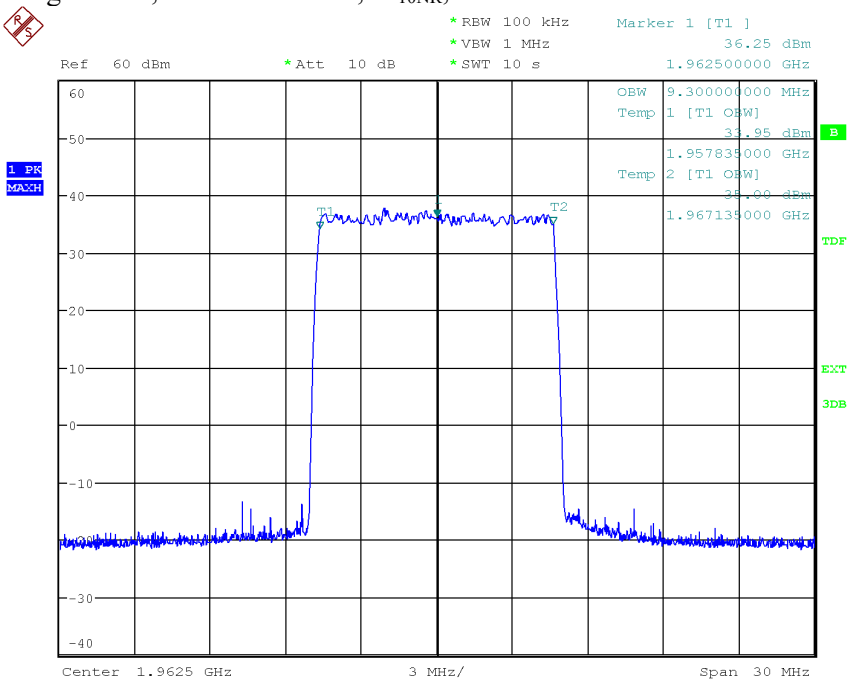
Diagram	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
1.1	M_{10NR}	RF A	9.300

B66 max power configuration:

Single carrier NR-FR1-TM1.1

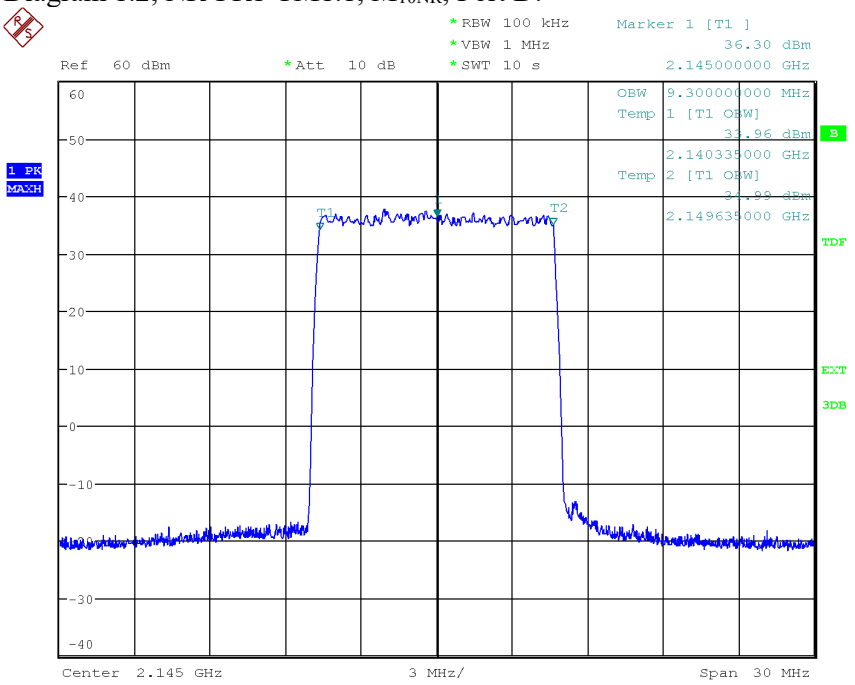
Diagram	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
1.2	M_{10NR}	RF A	9.300

Diagram 1.1, NR-FR1-TM1.1, M_{10NR}, Port D:



Date: 16.OCT.2020 17:38:35

Diagram 1.2, NR-FR1-TM1.1, M_{10NR}, Port D:



Date: 16.OCT.2020 17:47:49

Band edge measurements according to CFR 47 §24.238 and §27.53/ RSS-133 6.5, RSS-139 6.6

Date	Temperature	Humidity
2020-10-16	23 °C ± 3 °C	31 % ± 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.

A RBW of at least 1% of the EBW is to be used up to 1 MHz away from the band edges and for measurements more than 1 MHz from the band edges a RBW of 1 MHz is to be used.

From 1 MHz to 30 MHz away from the band edges a RBW of 100 kHz was used. To compensate for the reduced RBW the limit was adjusted by 10 dB to -23 dBm in this frequency range.

Before comparing the results to the limit, 6 dB [$10 \log_{10} (4)$] to cover 4x4 MIMO, should be added according to ANSI C63.26 6.4.4.1 c “measure and add $10 \log_{10} (N_{ANT})$”.

Measurement equipment	RISE number
R&S FSQ 40	504 143
Directional coupler	901 496
RF attenuator	902 282
Coaxial cable Megaphase	BX50191
Coaxial cable Sucoflex 102EA	BX50237
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 2.6 dB

Results NR

B25 max power configuration:

Single carrier NR-FR1-TM1.1

Diagram	Symbolic name	Tested Port
2.1 a-b	B_{10NR}	RF A
2.2 a-b	T_{10NR}	RF A

B2 max power configuration:

Single carrier NR-FR1-TM1.1

Diagram	Symbolic name	Tested Port
2.3 a-b	T_{10NR}	RF A

B66 max power configuration:

Single carrier TM1

Diagram	Symbolic name	Tested Port
2.4 a-b	B_{10NR}	RF A
2.5 a-b	T_{10NR}	RF A

Limits

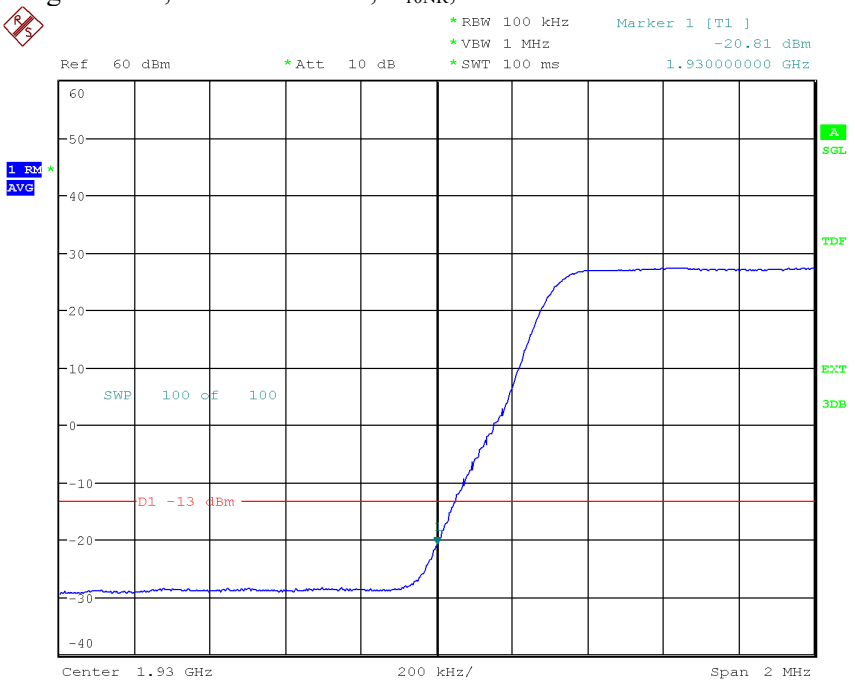
CFR 47 §24.238, §27.53(h) and RSS-133 6.5, RSS-139 6.6

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 $43 + 10 \log_{10}$ P(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 $43 + 10 \log_{10}$ P(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

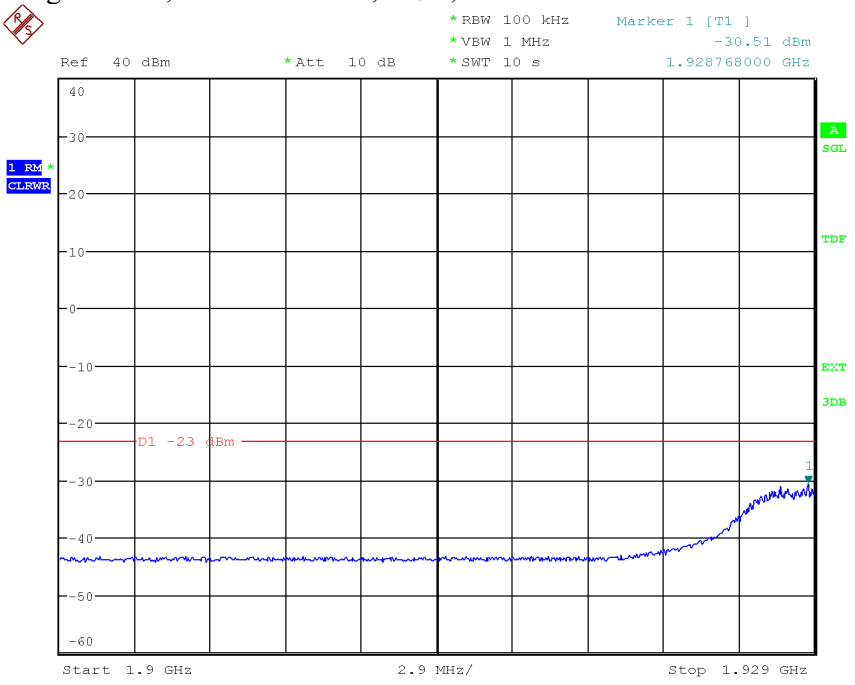
Complies?	Yes

Diagram 2.1a, NR-FR1-TM1.1, B_{10NR}, Port A:



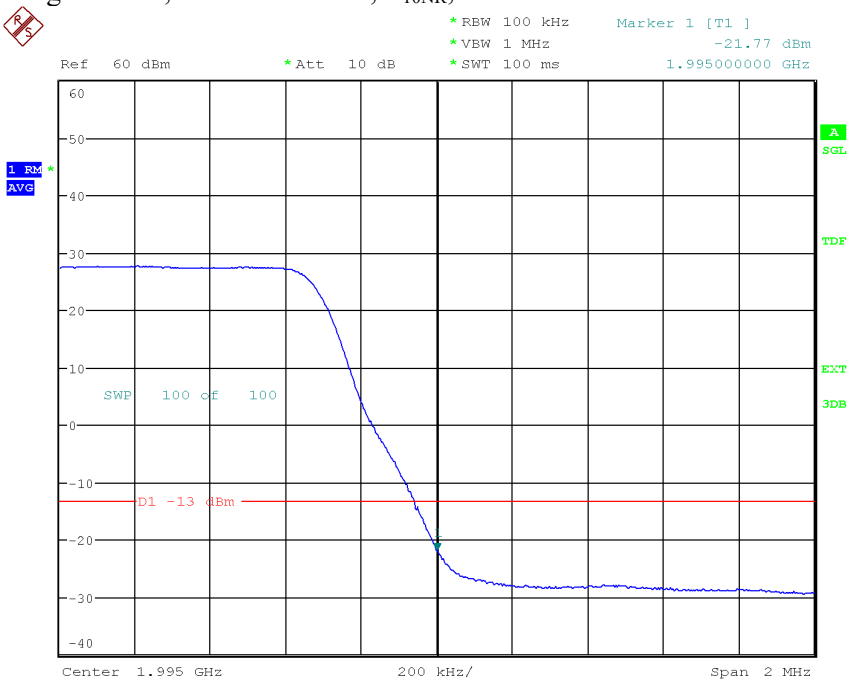
Date: 16.OCT.2020 18:09:23

Diagram 2.1b, NR-FR1-TM1.1, B_{10NR}, Port A:



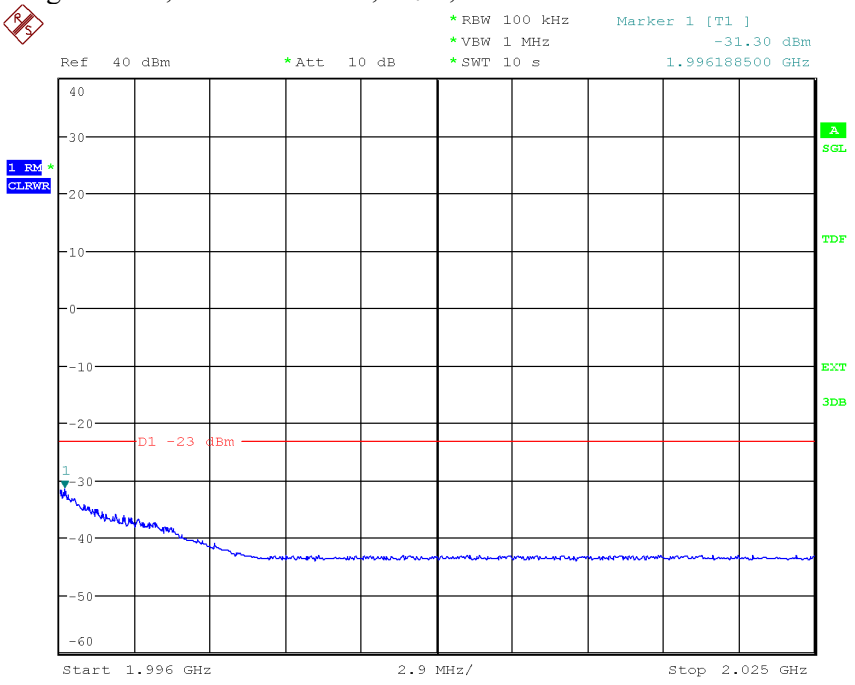
Date: 16.OCT.2020 18:04:45

Diagram 2.2a, NR-FR1-TM1.1, T_{10NR}, Port D:



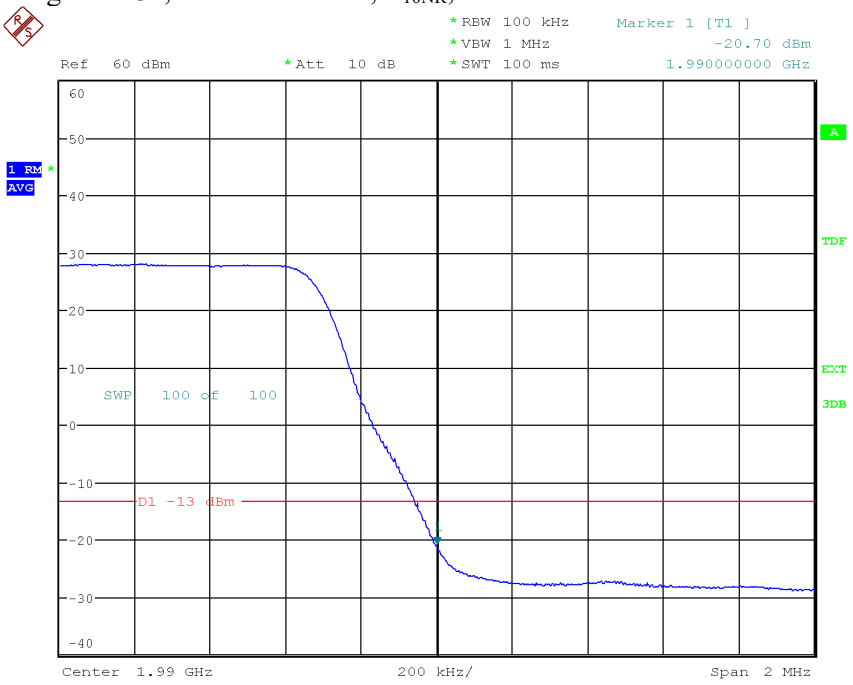
Date: 16.OCT.2020 18:13:01

Diagram 2.2b, NR-FR1-TM1.1, T_{10NR}, Port D:



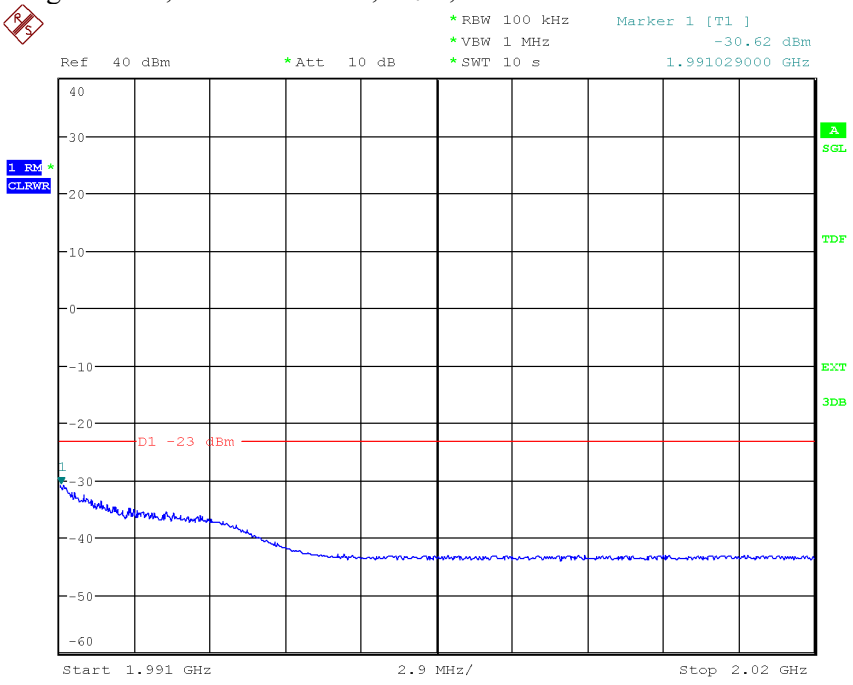
Date: 16.OCT.2020 18:15:22

Diagram 2.3a, NR-FR1-TM1.1, T_{10NR}, Port A:



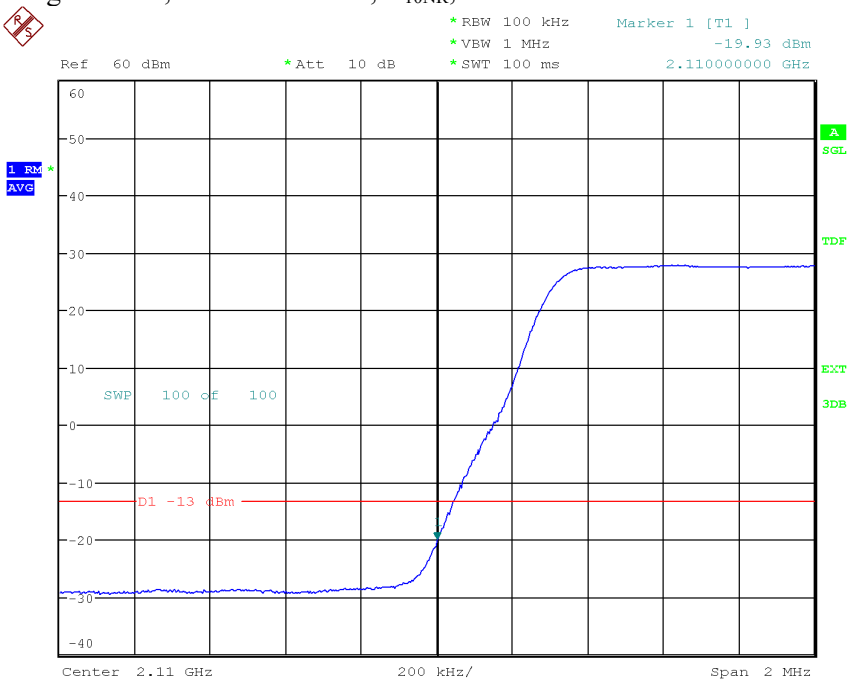
Date: 16.OCT.2020 18:24:21

Diagram 2.3b, NR-FR1-TM1.1, T_{10NR}, Port A:



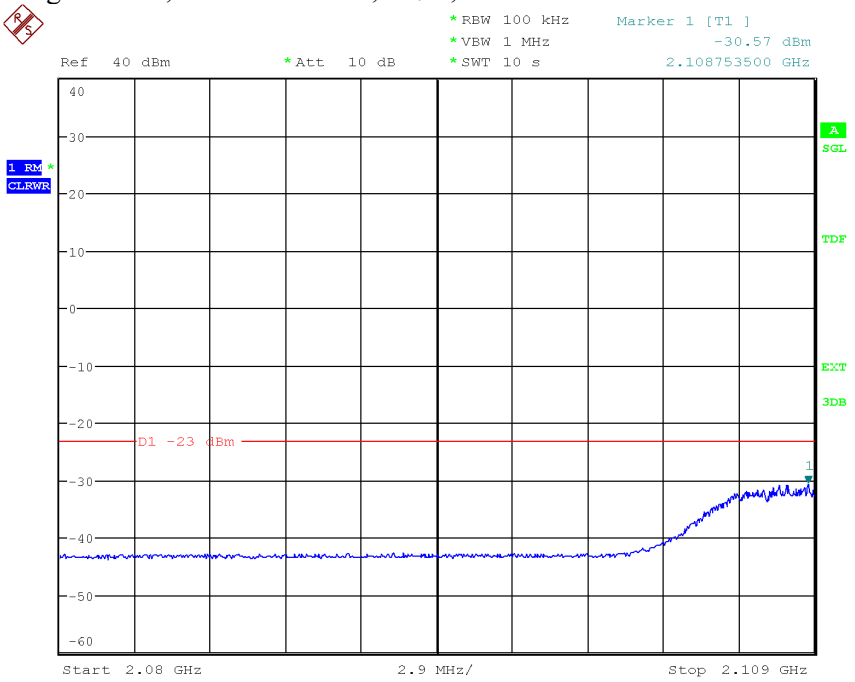
Date: 16.OCT.2020 18:17:43

Diagram 2.4a, NR-FR1-TM1.1, B_{10NR}, Port A:



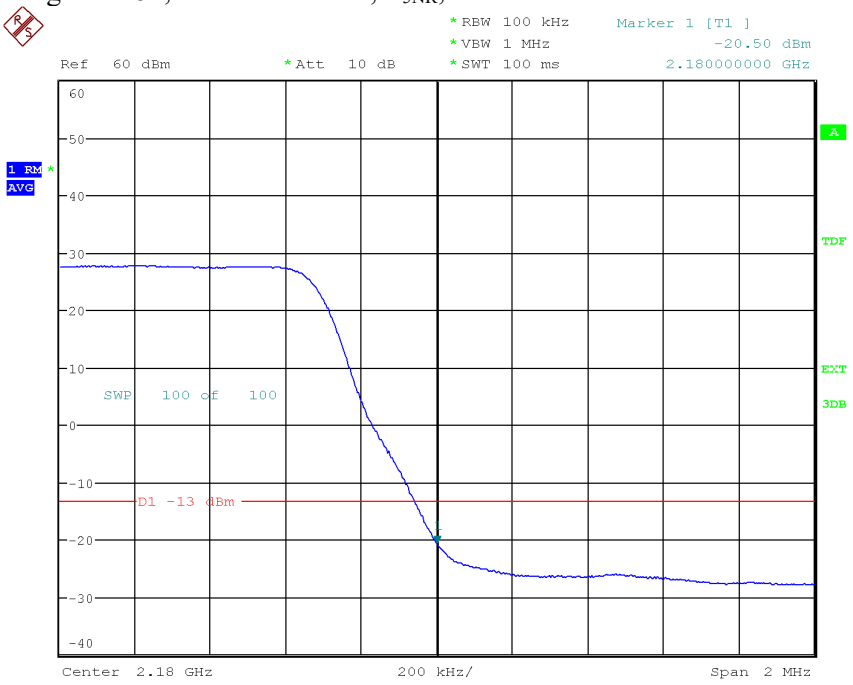
Date: 16.OCT.2020 18:28:09

Diagram 2.4b, NR-FR1-TM1.1, B_{10NR}, Port A:



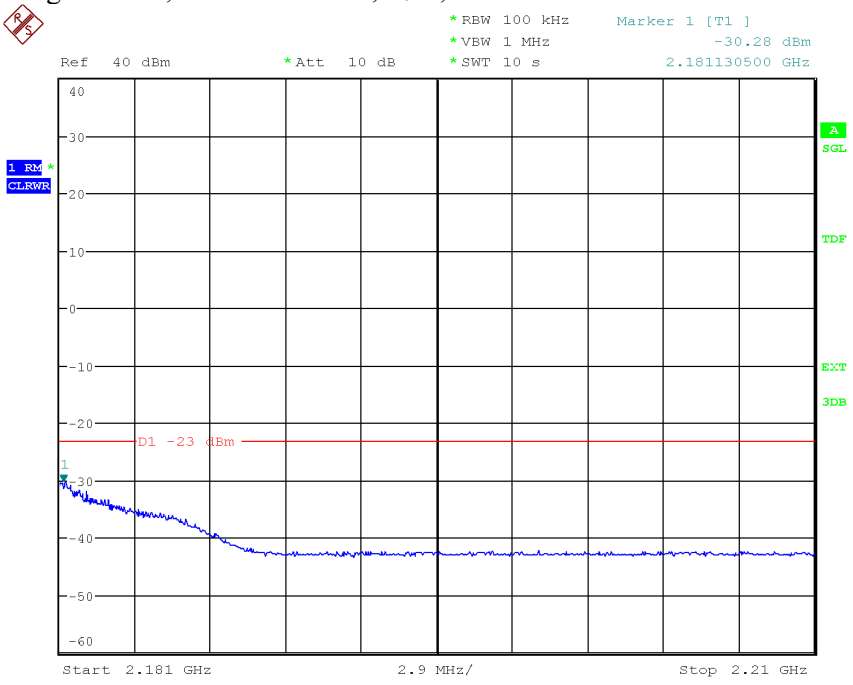
Date: 16.OCT.2020 18:31:41

Diagram 2.5a, NR-FR1-TM1.1, T_{5NR}, Port D:



Date: 16.OCT.2020 18:40:29

Diagram 2.5b, NR-FR1-TM1.1, T_{5NR}, Port D:



Date: 16.OCT.2020 18:35:40

Conducted spurious emission measurements according to CFR 47 §24.238 and §27.53(h) / RSS-133 6.5, RSS-139 6.6

Date	Temperature	Humidity
2020-08-28	22 °C ± 3 °C	47 % ± 5 %
2020-09-07	22 °C ± 3 °C	43 % ± 5 %
2020-09-08	22 °C ± 3 °C	46 % ± 5 %
2020-09-09	23 °C ± 3 °C	61 % ± 5 %
2020-09-23	22 °C ± 3 °C	55 % ± 5 %
2020-09-30	24 °C ± 3 °C	35 % ± 5 %

Test set-up and procedure

The measurements were made per definition in ANSI C63.26, 5.7.4. The output was connected to a spectrum analyzer with the RMS detector activated.

Before comparing the results to the limit, 6 dB [10 $\log_{10}$ (4)] to cover 4x4 MIMO, should be added according to ANSI C63.26 6.4.4.1 c “measure and add 10 $\log_{10}$ (N_{ANT})”.

Measurement equipment	RISE number
R&S FSQ 40	504 143
Directional coupler	901 496
RF attenuator	902 282
High pass filter 3-27 GHz	901 502
Coaxial cable Megaphase	BX50191
Coaxial cable Sucoflex 102EA	BX50236
Coaxial cable Sucoflex 102EA	BX50237
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 2.6 dB

Results GSM+NB IoT SA+LTE

B2 max power configuration:

Multi RAT: GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1,

Diagram	Symbolic name	Tested Port
3.1 a-e	$Bim_{G+IoT+L}$	RF A
3.2 a-e	$Tim_{G+IoT+L}$	RF A
3.3 a-e	$Max_{G+IoT+L}$	RF A

Results NR+LTE+NB IoT SA

B25 max power configuration:

Multi RAT: NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM

Diagram	Symbolic name	Tested Port
3.4 a-c	$Bim_{NR+L+IoT}$	RF A
3.5 a-c	$Tim_{NR+L+IoT}$	RF A
3.6 a-c	$Max_{NR+L+IoT}$	RF A

B66 max power configuration:

Multi RAT: NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM

Diagram	Symbolic name	Tested Port
3.7 a-c	$Bim_{NR+L+IoT}$	RF A
3.8 a-c	$Tim_{NR+L+IoT}$	RF A
3.9 a-c	$Max_{NR+L+IoT}$	RF A

Results NR+LTE+WCDMA

B25 max power configuration:

Multi RAT: NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1

Diagram	Symbolic name	Tested Port
3.10 a-c	Bim_{NR+L+W}	RF A
3.11 a-c	Tim_{NR+L+W}	RF A
3.12 a-c	Max_{NR+L+W}	RF A

B66 max power configuration:

Multi RAT: NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1

Diagram	Symbolic name	Tested Port
3.13 a-c	Bim_{NR+L+W}	RF A
3.14 a-c	Tim_{NR+L+W}	RF A
3.15 a-c	Max_{NR+L+W}	RF A

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 2180 MHz. The measurements were made up to 22 GHz (10x2180 MHz = 21.80 GHz).

Limits

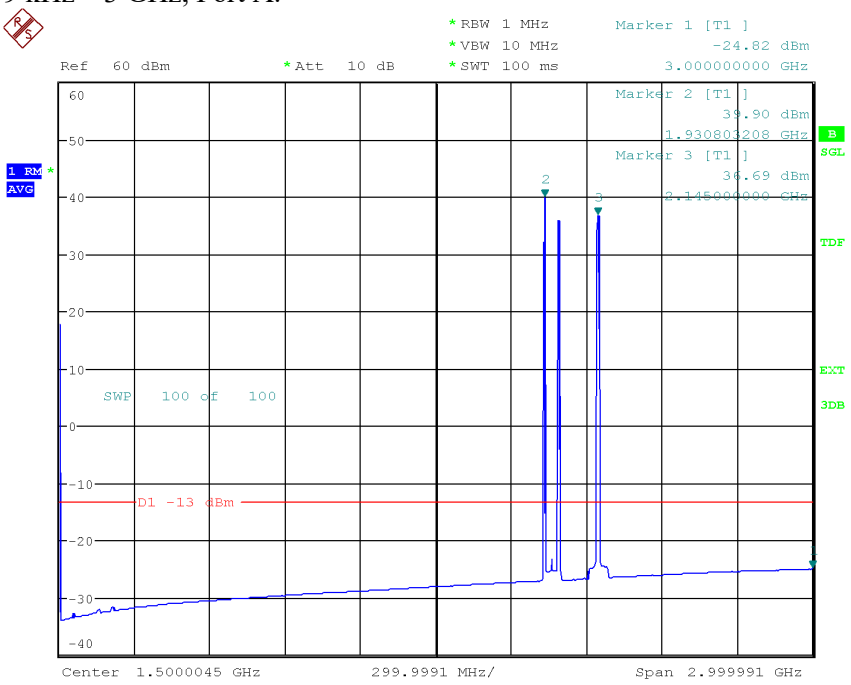
CFR 47 §24.238, §27.53(h) and RSS-133 6.5, RSS-139 6.6

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 $43 + 10 \log_{10}$ P(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 $43 + 10 \log_{10}$ P(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

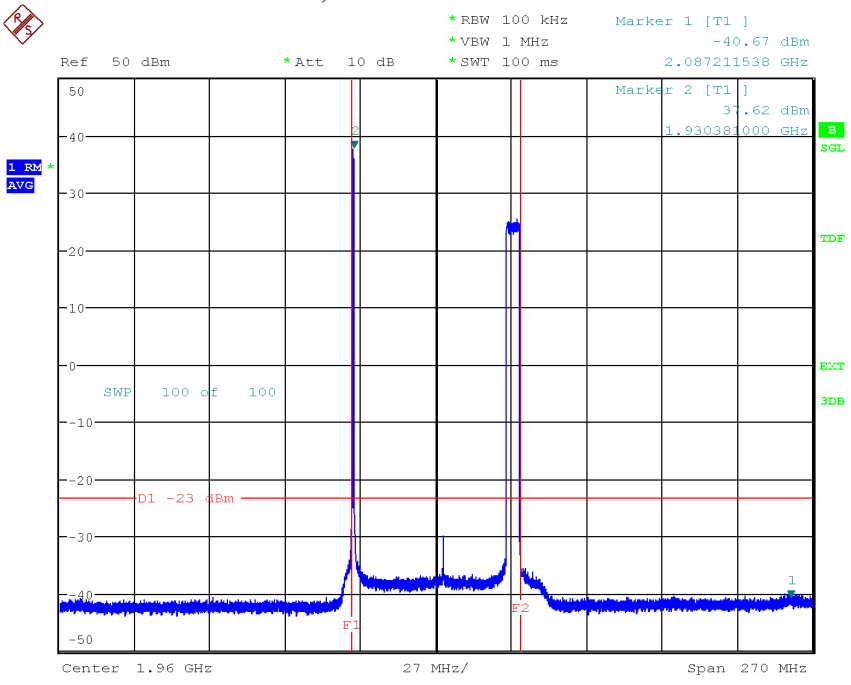
Complies?	Yes

Diagram 3.1a, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Bim_{G+IoT+L}$, 9 kHz – 3 GHz, Port A:



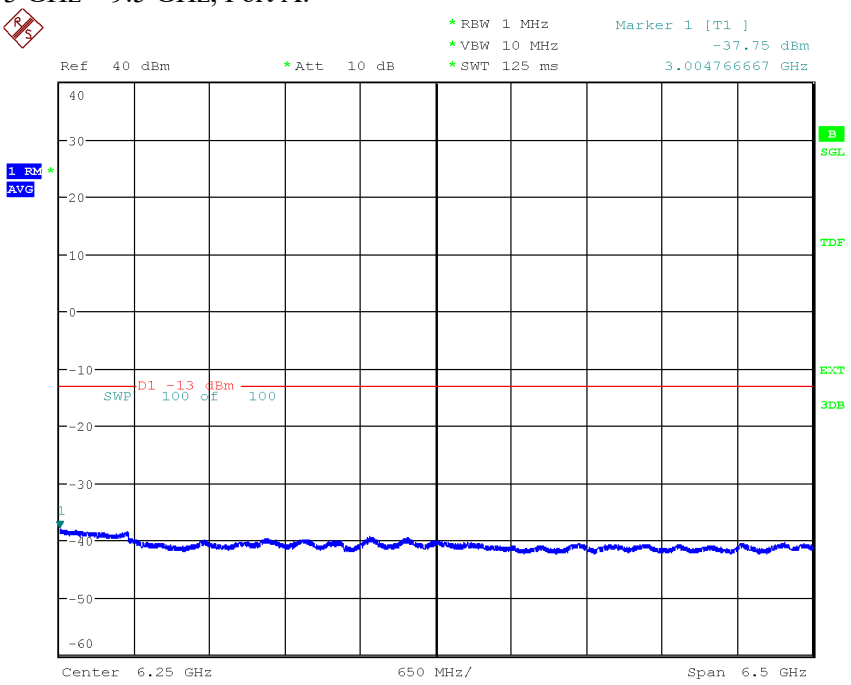
Date: 7.SEP.2020 15:36:04

Diagram 3.1b, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Bim_{G+IoT+L}$, 1.8275 GHz – 2.0975 GHz, Port A:



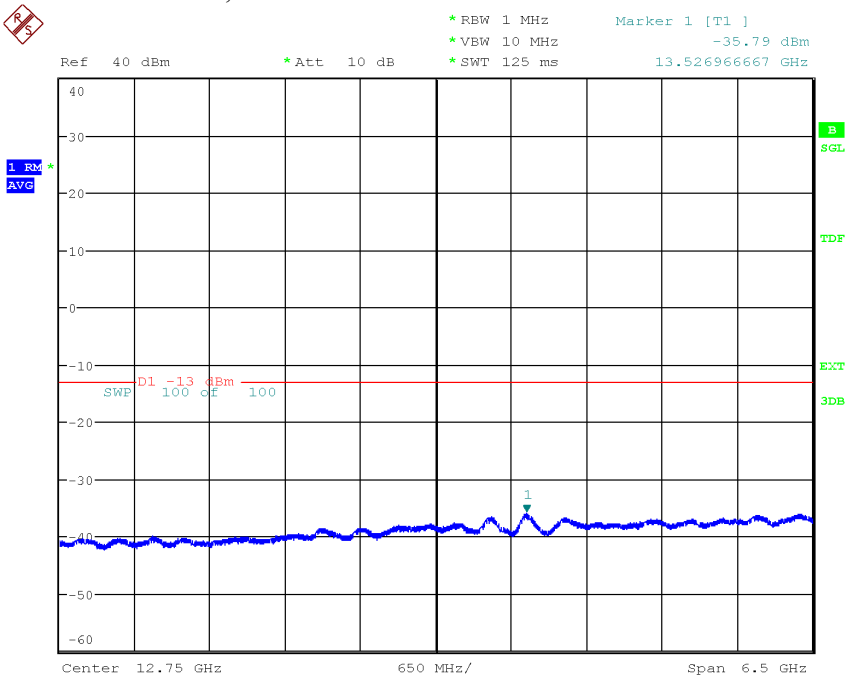
Date: 7.SEP.2020 14:59:59

Diagram 3.1c, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Bim_{G+IoT+L}$, 3 GHz – 9.5 GHz, Port A:



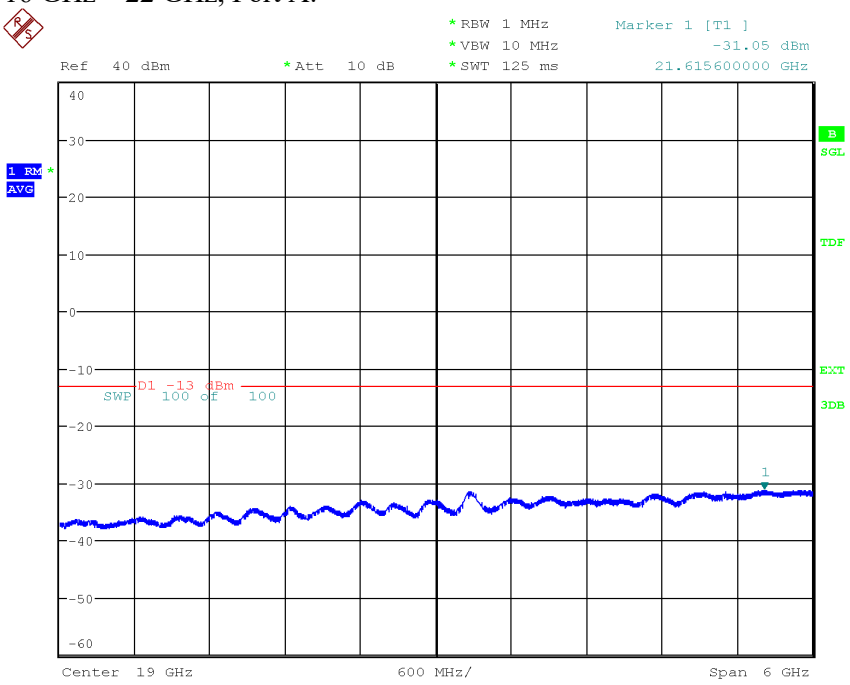
Date: 7.SEP.2020 15:43:32

Diagram 3.1d, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Bim_{G+IoT+L}$, 9.5 GHz – 16 GHz, Port A:



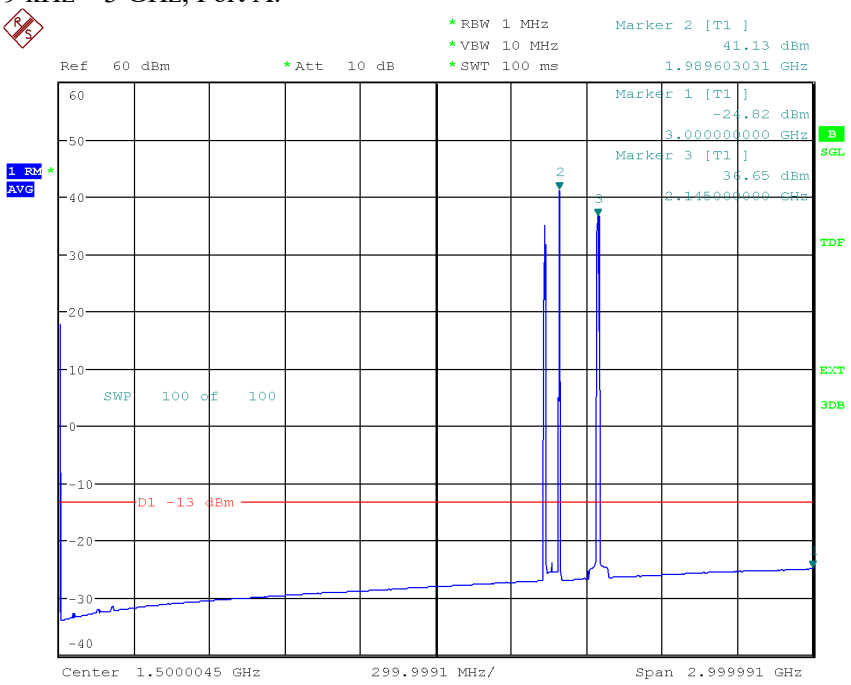
Date: 7.SEP.2020 15:48:23

Diagram 3.1e, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Bim_{G+IoT+L}$, 16 GHz – 22 GHz, Port A:



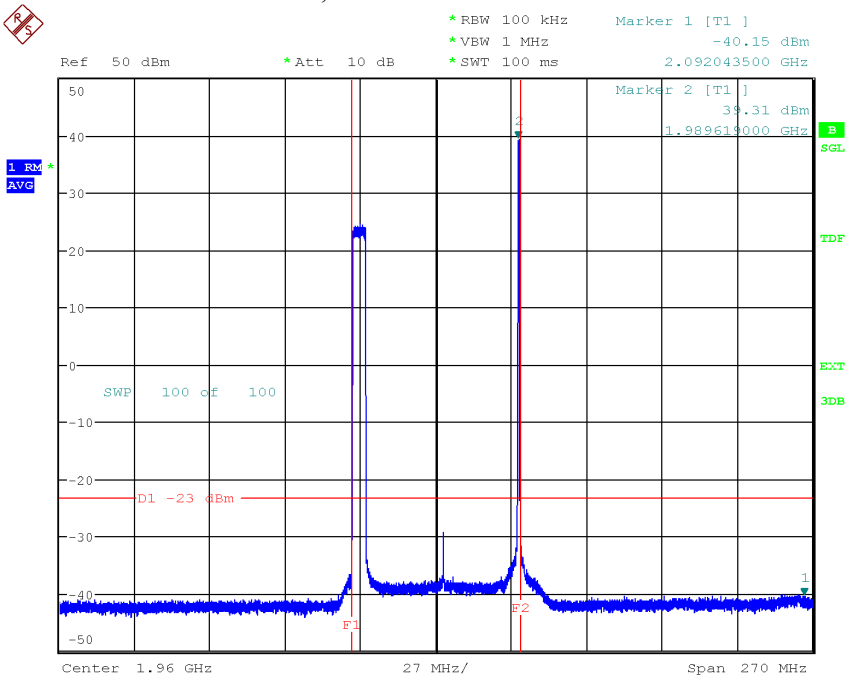
Date: 7.SEP.2020 15:51:07

Diagram 3.2a, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Tim_{G+IoT+L}$, 9 kHz – 3 GHz, Port A:



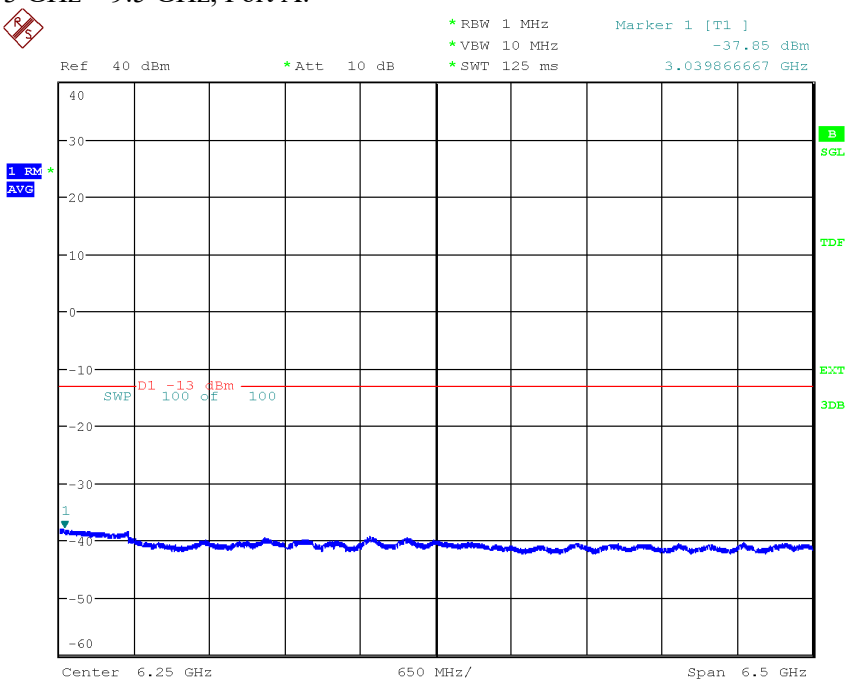
Date: 7.SEP.2020 16:27:49

Diagram 3.2b, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Tim_{G+IoT+L}$, 1.8275 GHz – 2.0975 GHz, Port A:



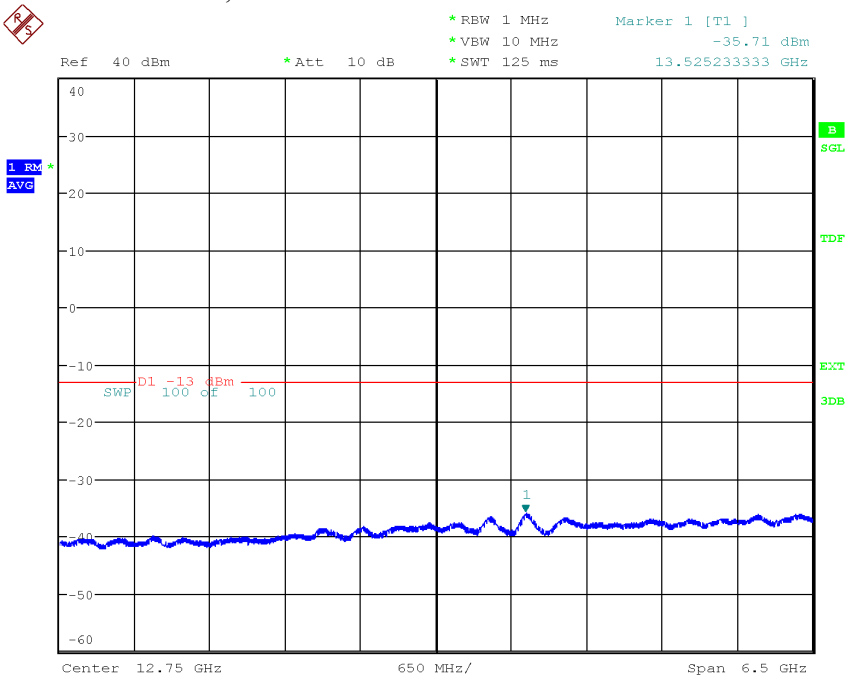
Date: 7.SEP.2020 16:26:15

Diagram 3.2c, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Tim_{G+IoT+L}$, 3 GHz – 9.5 GHz, Port A:



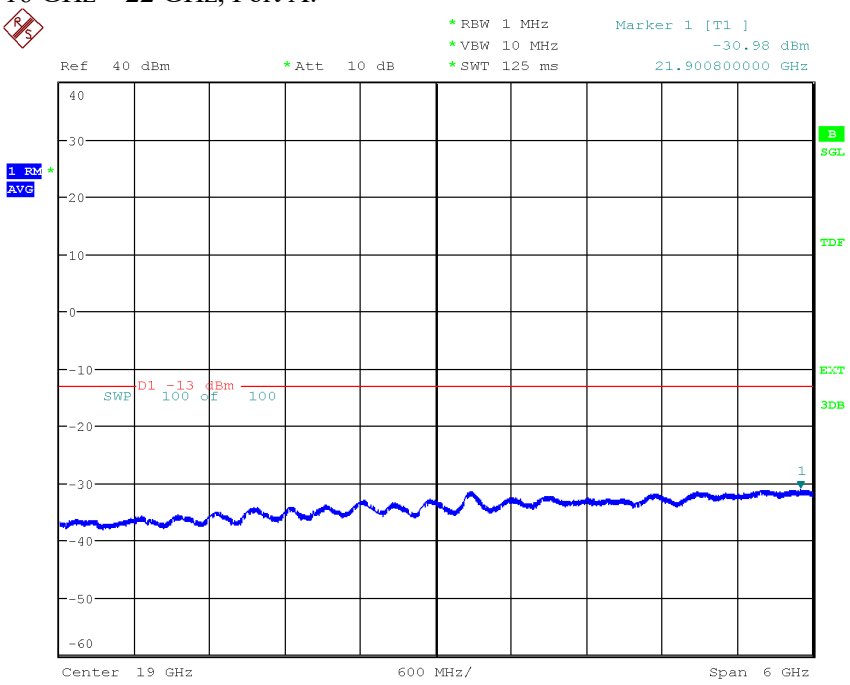
Date: 7.SEP.2020 16:23:53

Diagram 3.2d, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Tim_{G+IoT+L}$, 9.5 GHz – 16 GHz, Port A:



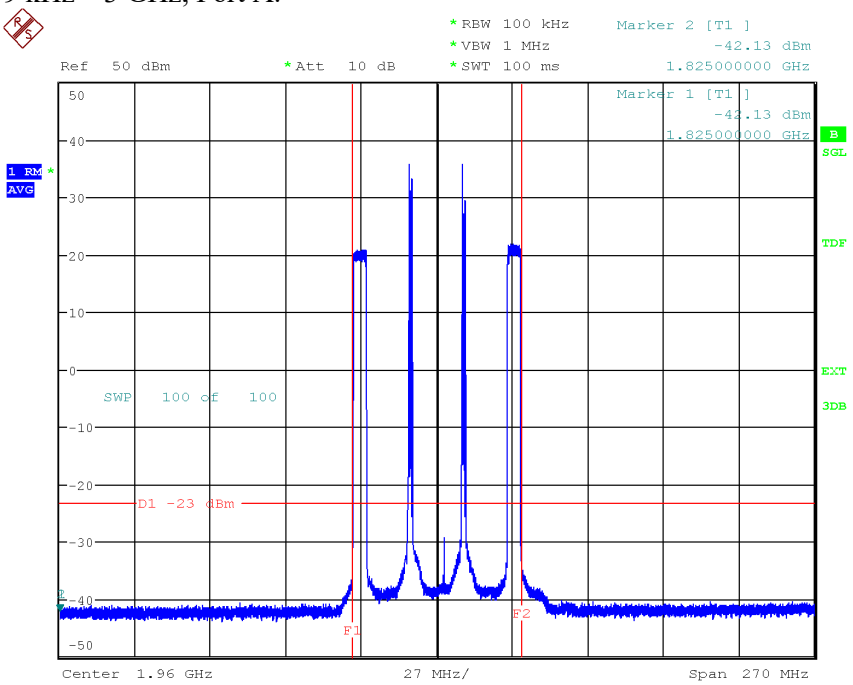
Date: 7.SEP.2020 16:21:19

Diagram 3.2e, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Tim_{G+IoT+L}$, 16 GHz – 22 GHz, Port A:



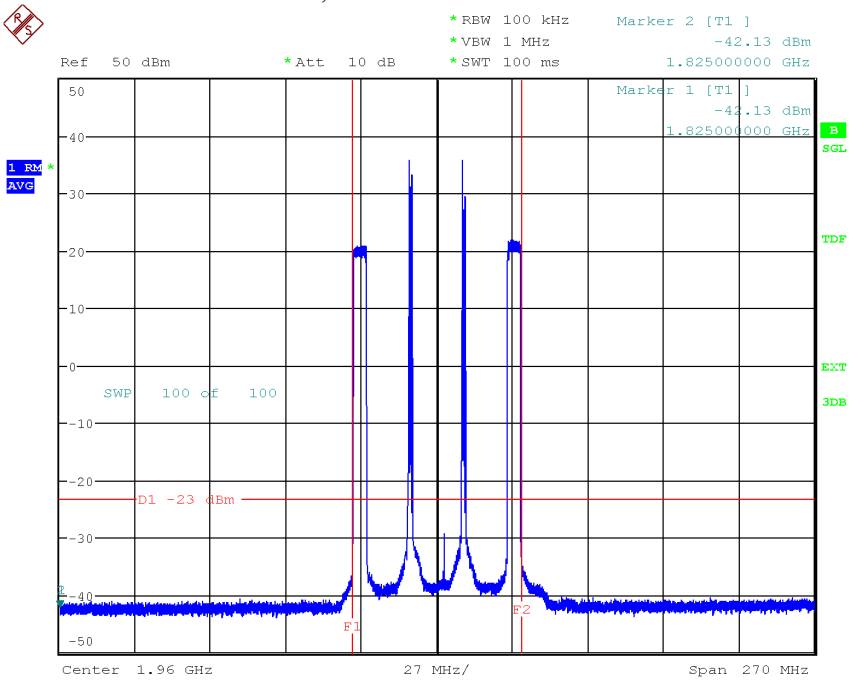
Date: 7.SEP.2020 16:17:10

Diagram 3.3a, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Max_{G+IoT+L}$, 9 kHz – 3 GHz, Port A:



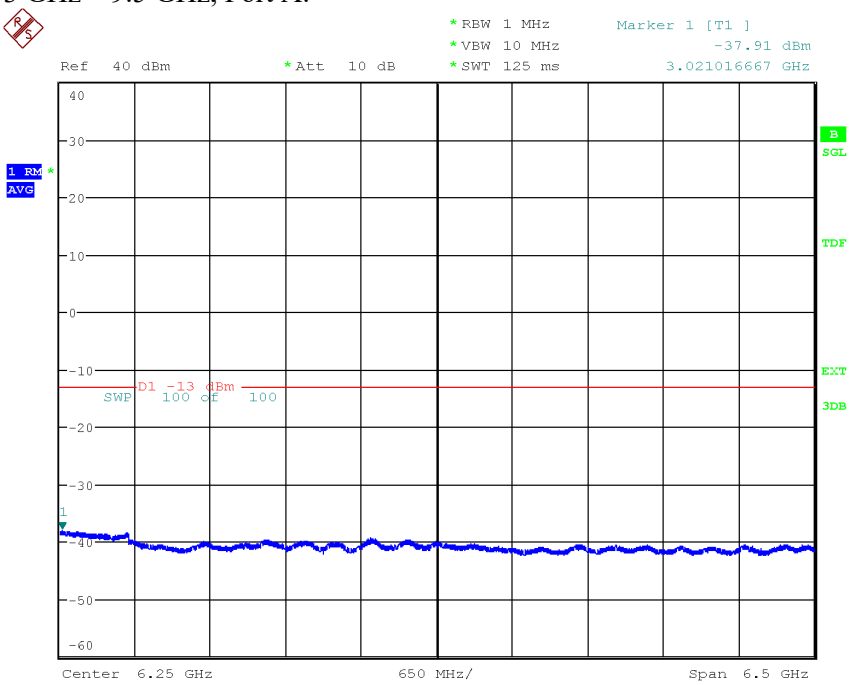
Date: 28.AUG.2020 13:23:28

Diagram 3.3b, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Max_{G+IoT+L}$, 1.8275 GHz – 2.0975 GHz, Port A:



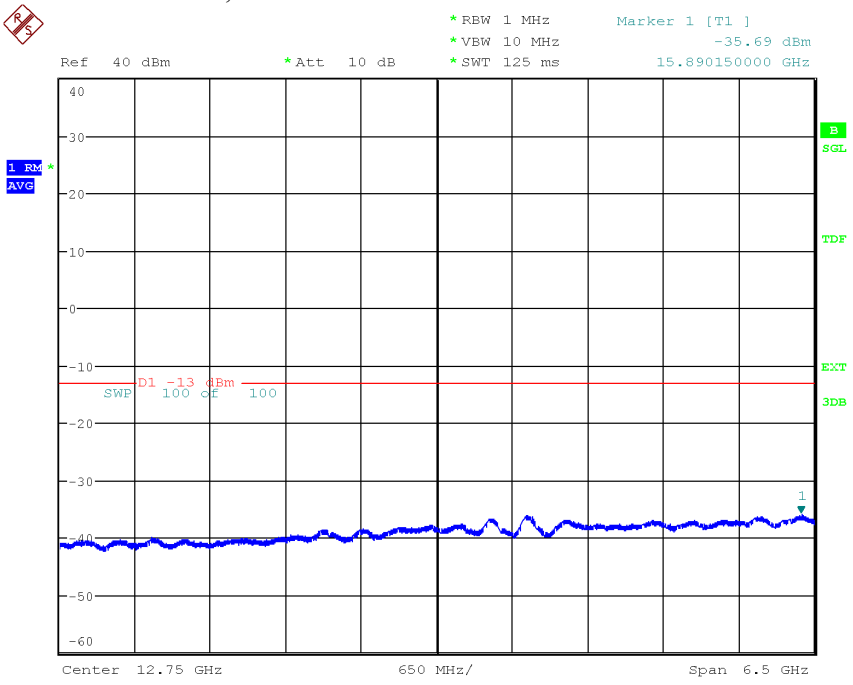
Date: 28.AUG.2020 13:23:28

Diagram 3.3c, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Max_{G+IoT+L}$, 3 GHz – 9.5 GHz, Port A:



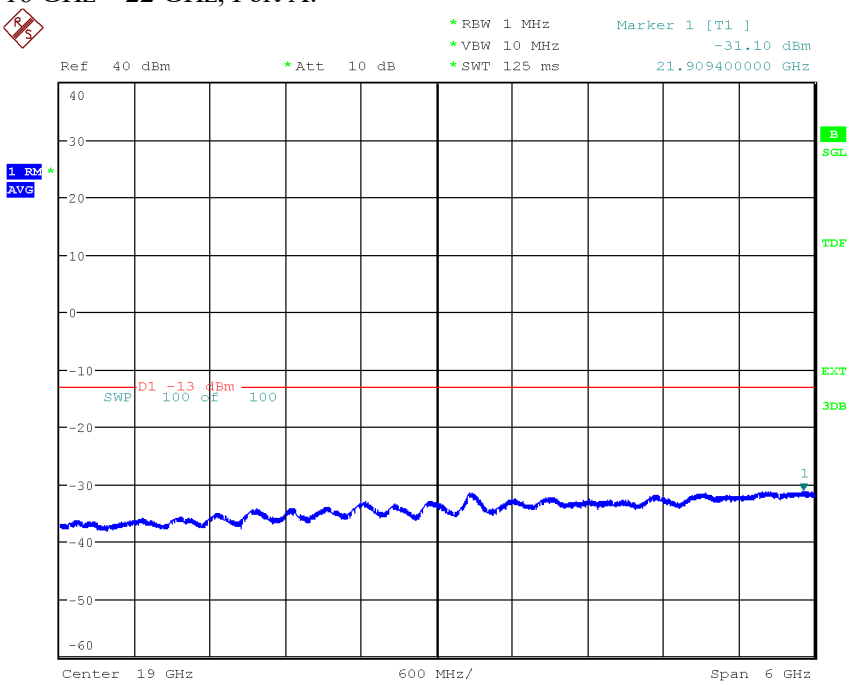
Date: 28.AUG.2020 13:14:52

Diagram 3.3d, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Max_{G+IoT+L}$, 9.5 GHz – 16 GHz, Port A:



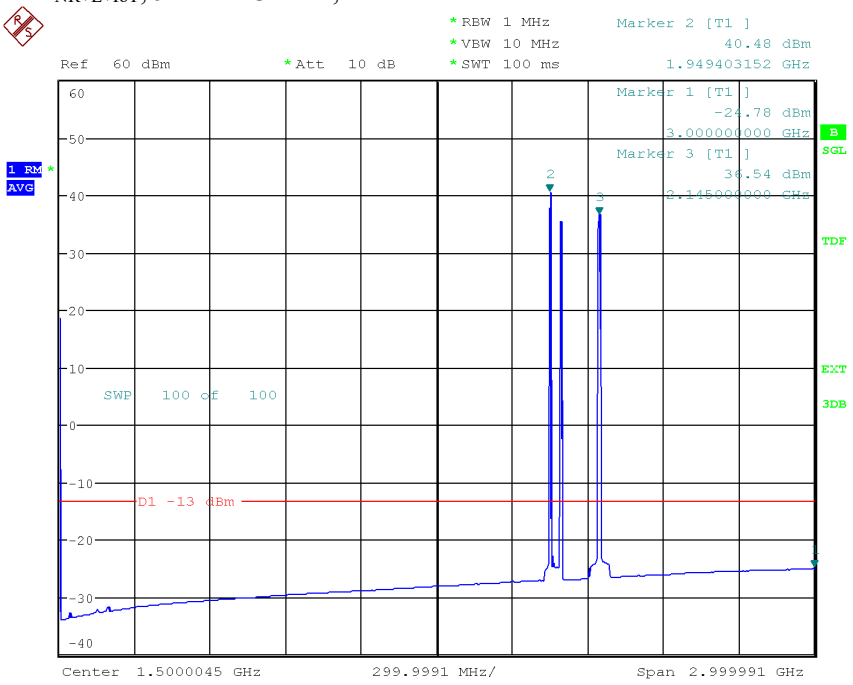
Date: 28.AUG.2020 13:09:09

Diagram 3.3e, GSM: GMSK, NB IoT SA: N-TM, LTE: E-TM1.1, $Max_{G+IoT+L}$, 16 GHz – 22 GHz, Port A:



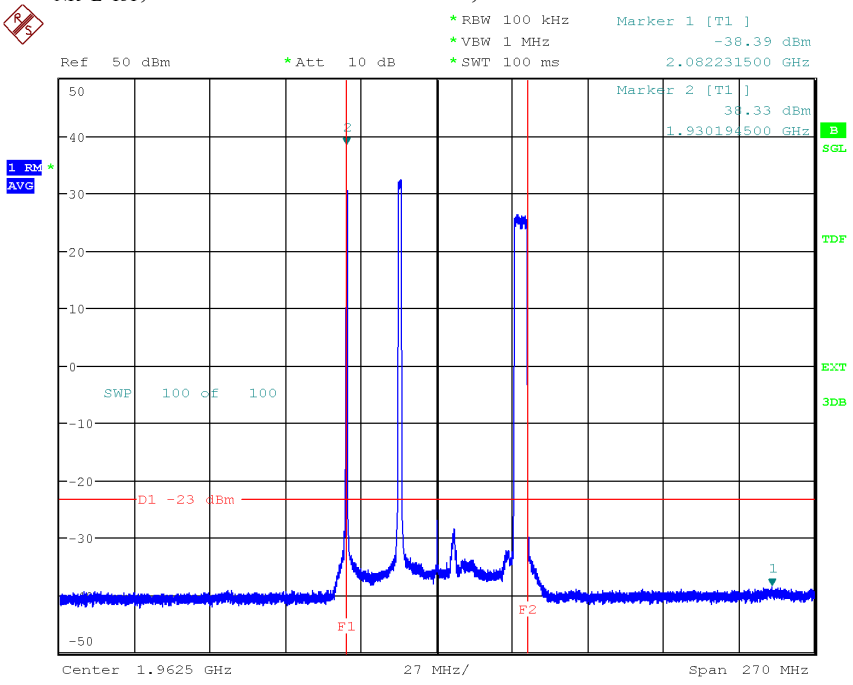
Date: 28.AUG.2020 13:05:27

Diagram 3.4a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



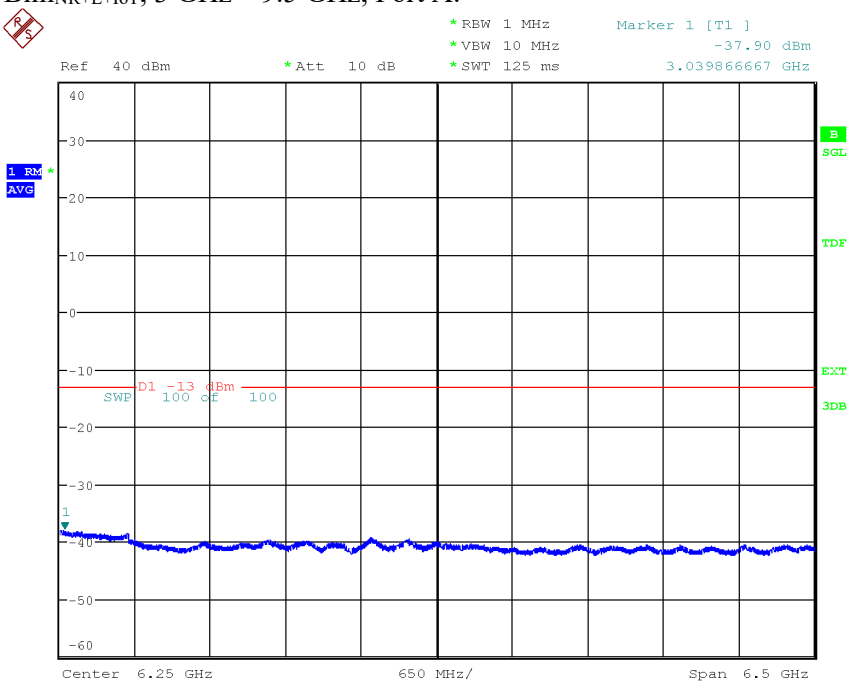
Date: 8.SEP.2020 11:06:21

Diagram 3.4b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 1.8275 GHz – 2.0975 GHz, Port A:



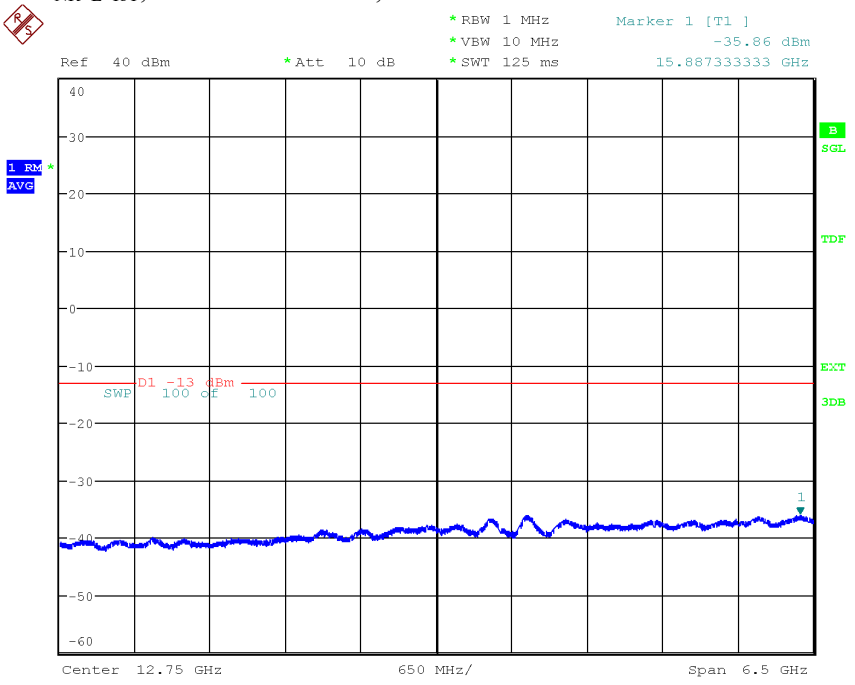
Date: 23.SEP.2020 10:33:10

Diagram 3.4c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:



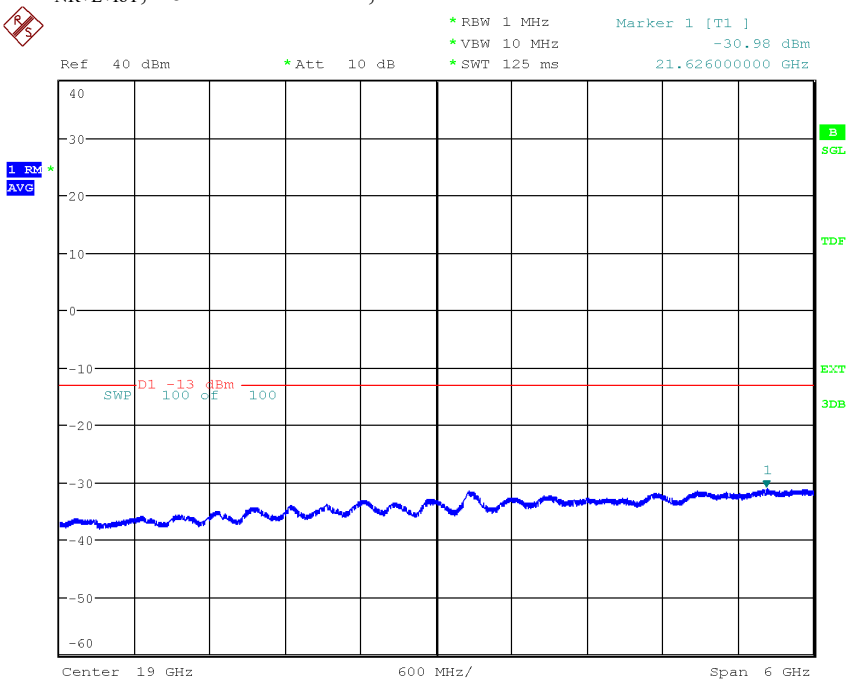
Date: 8.SEP.2020 14:22:57

Diagram 3.4d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:



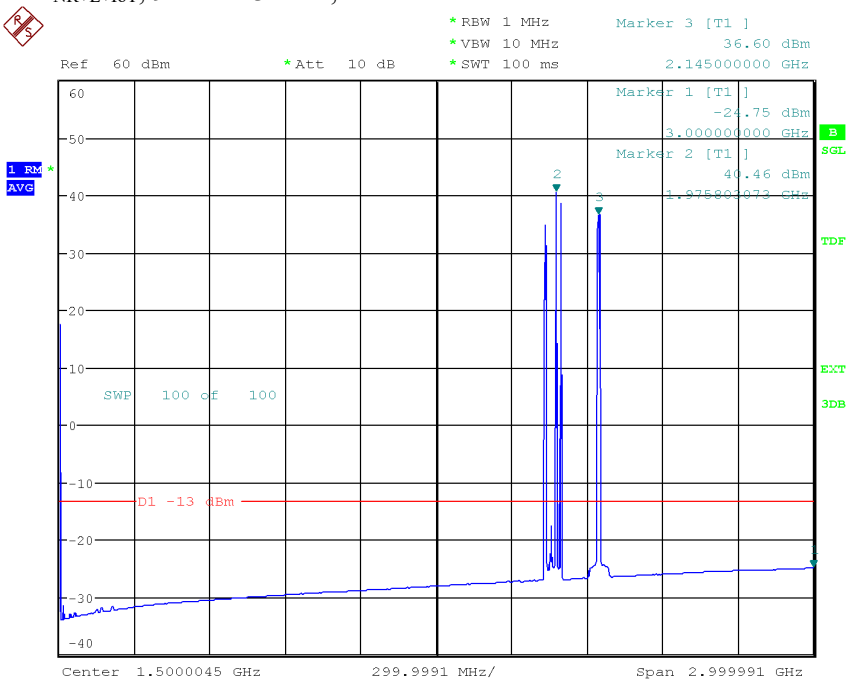
Date: 8.SEP.2020 14:32:42

Diagram 3.4e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:



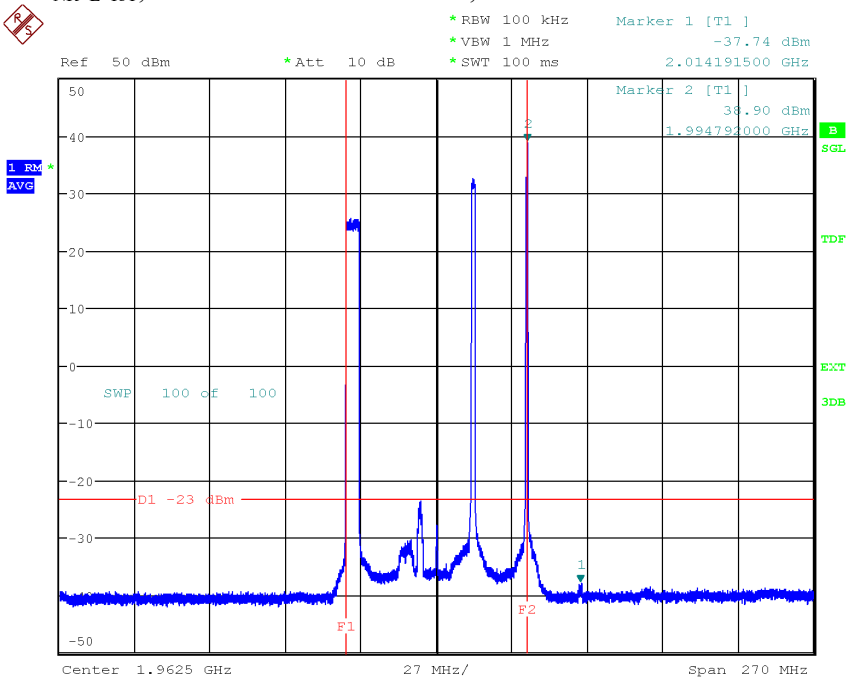
Date: 8.SEP.2020 14:36:36

Diagram 3.5a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



Date: 8.SEP.2020 15:51:34

Diagram 3.5b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 1.8275 GHz – 2.0975 GHz, Port A:



Date: 23.SEP.2020 10:37:51

Diagram 3.5c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:

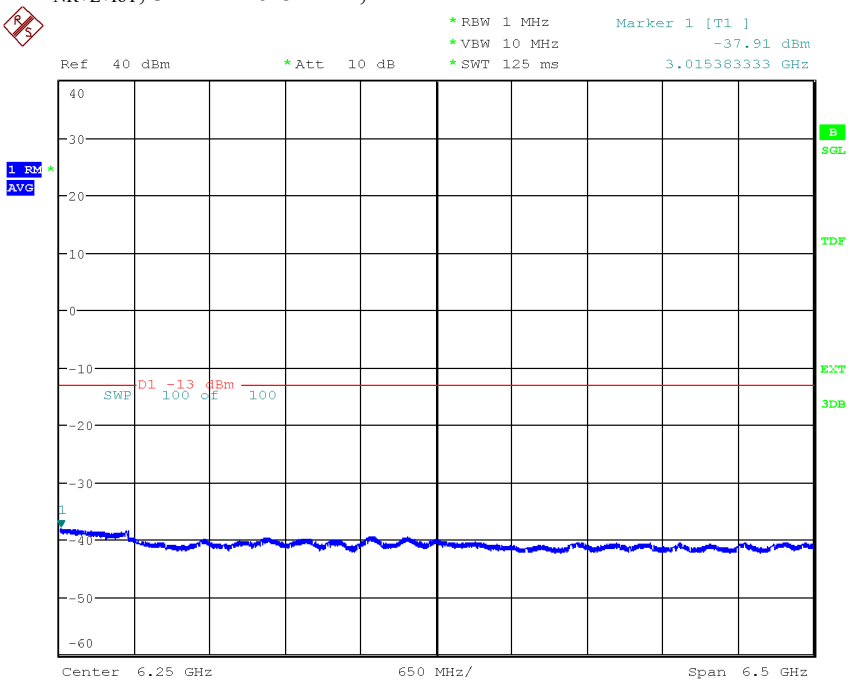


Diagram 3.5d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:

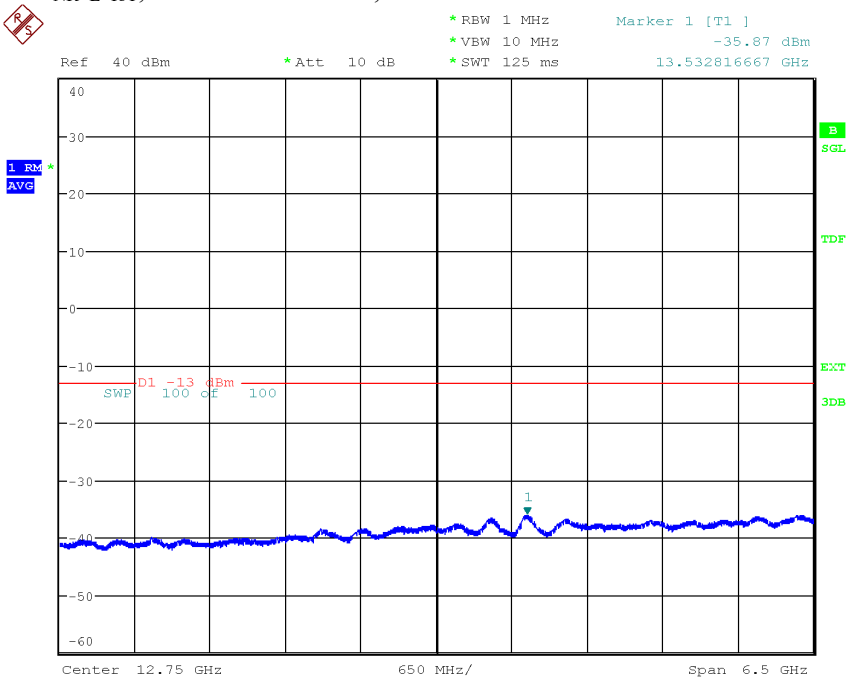
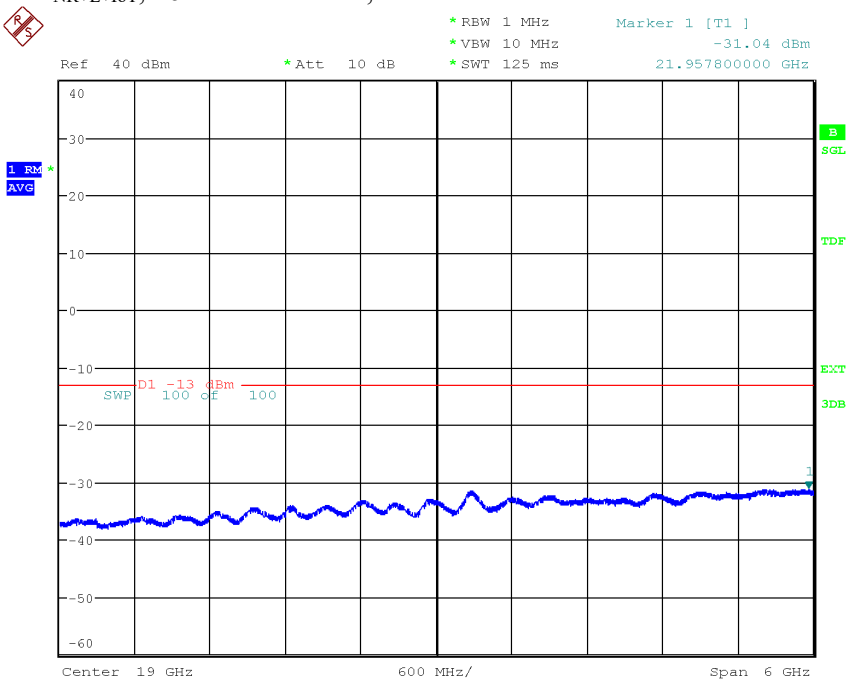
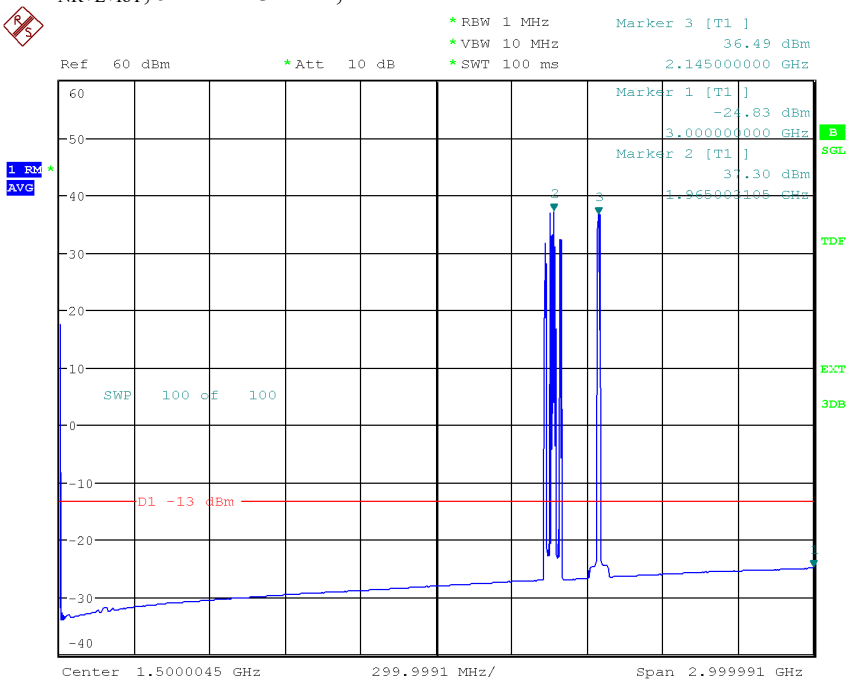


Diagram 3.5e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:



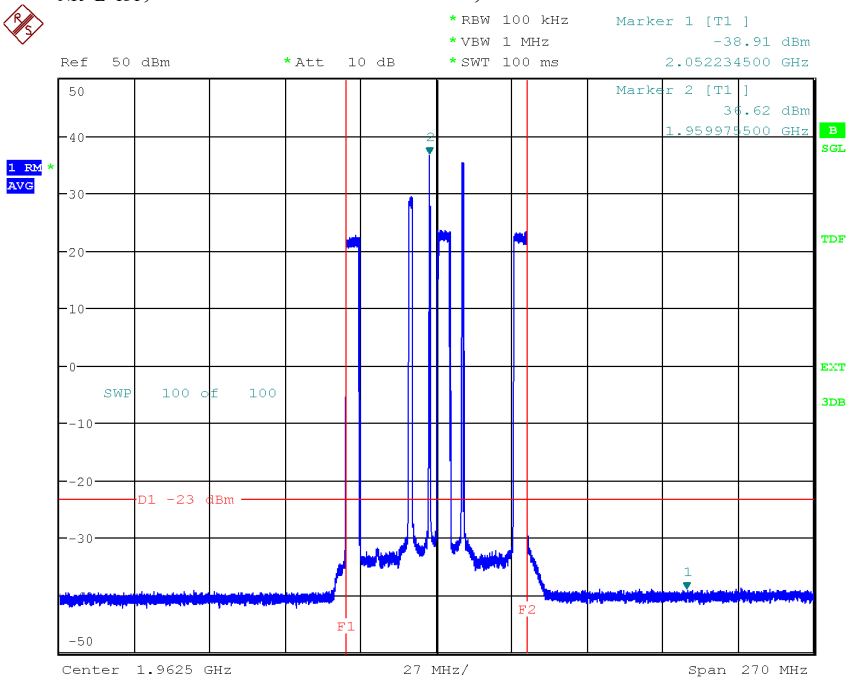
Date: 8.SEP.2020 15:39:57

Diagram 3.6a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



Date: 8.SEP.2020 16:04:36

Diagram 3.6b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 1.8275 GHz – 2.0975 GHz, Port A:



Date: 23.SEP.2020 10:44:39

Diagram 3.6c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:

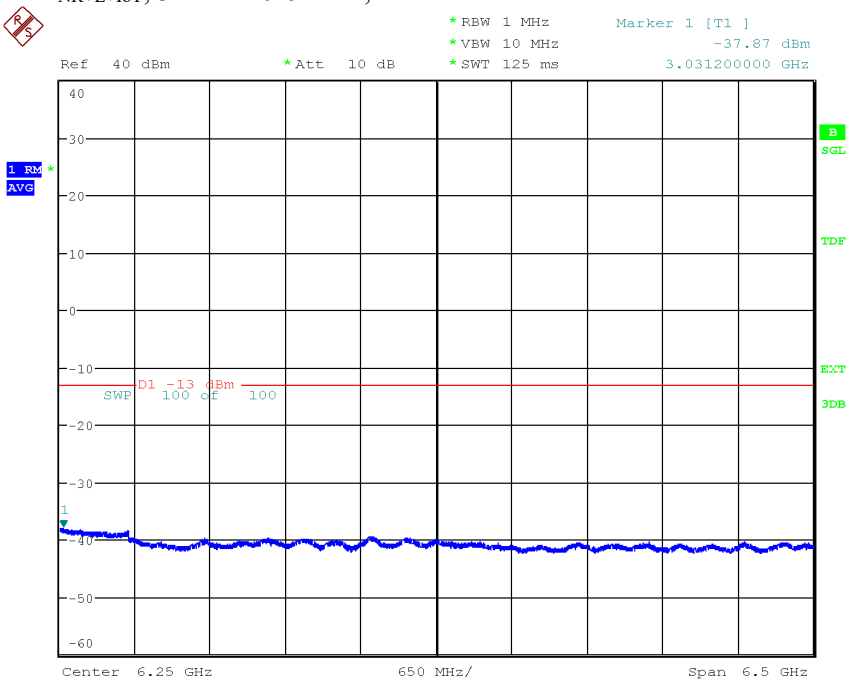


Diagram 3.6d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:

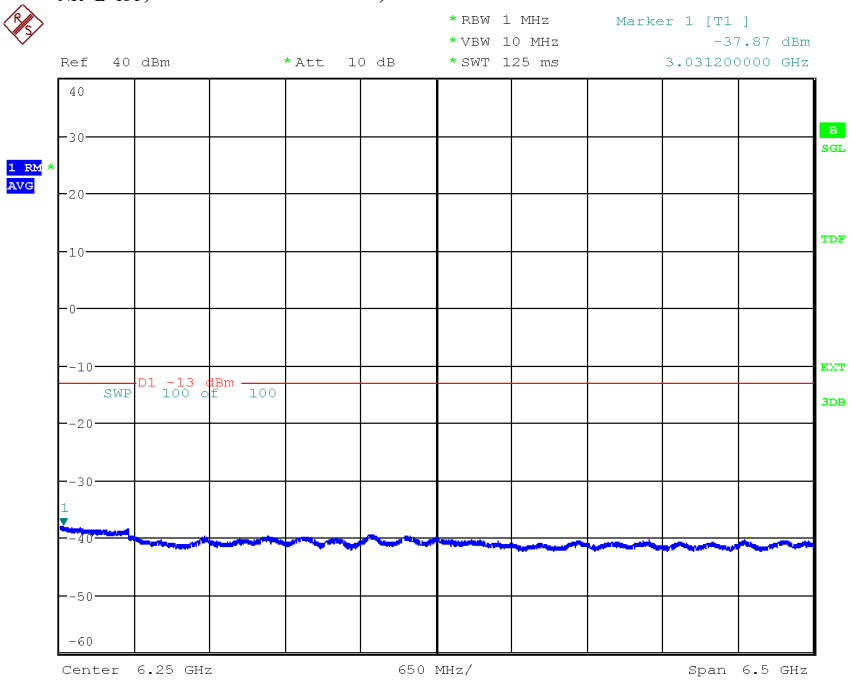


Diagram 3.6e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:

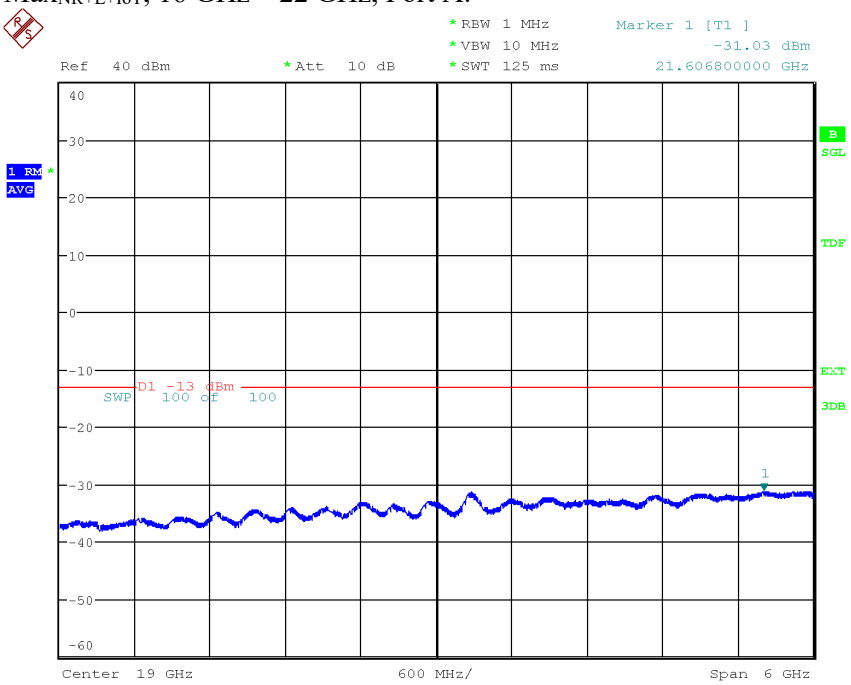
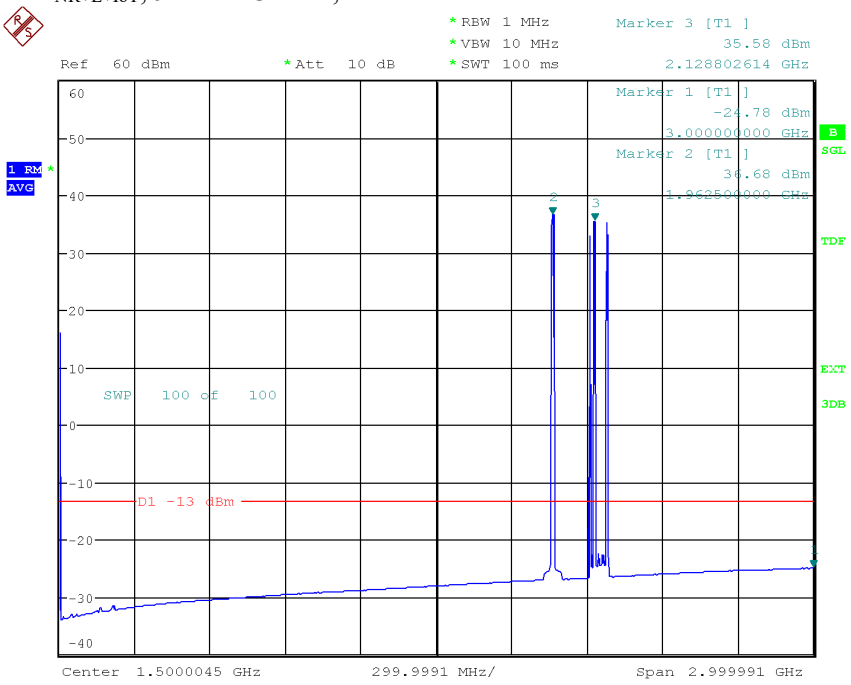
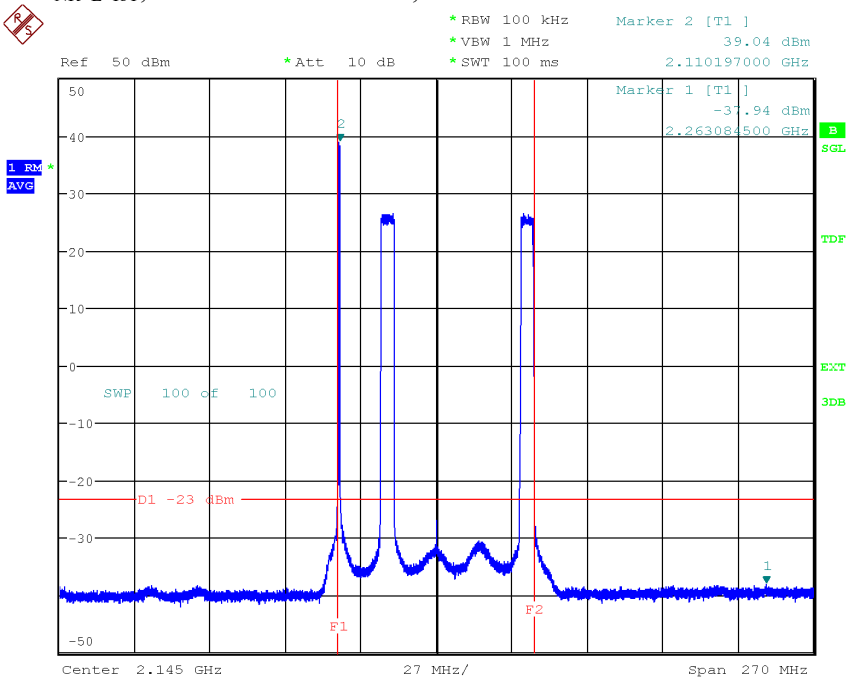


Diagram 3.7a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



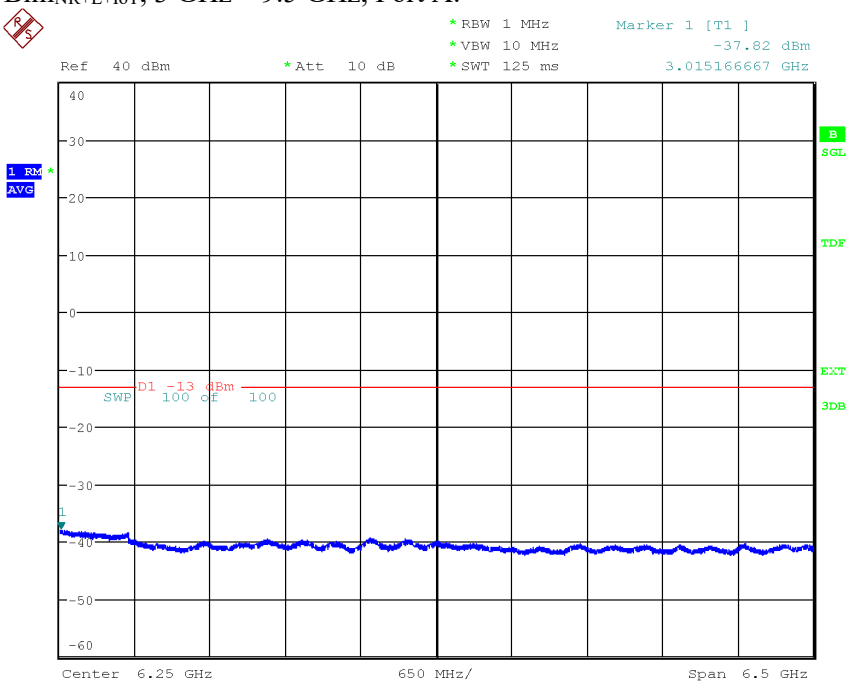
Date: 9.SEP.2020 13:29:24

Diagram 3.7b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 2.01 GHz – 2.28 GHz, Port A:



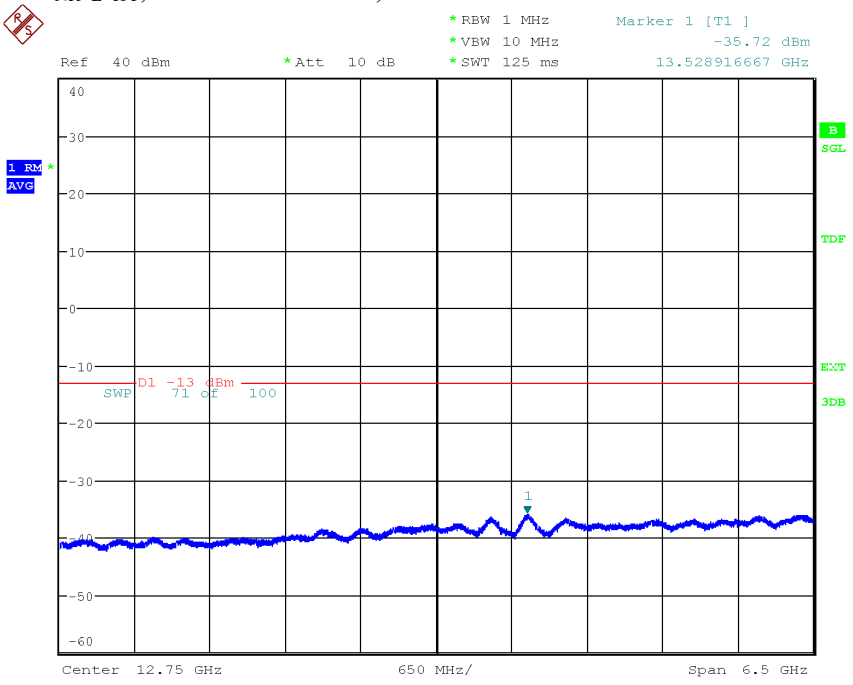
Date: 23.SEP.2020 12:04:34

Diagram 3.7c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:



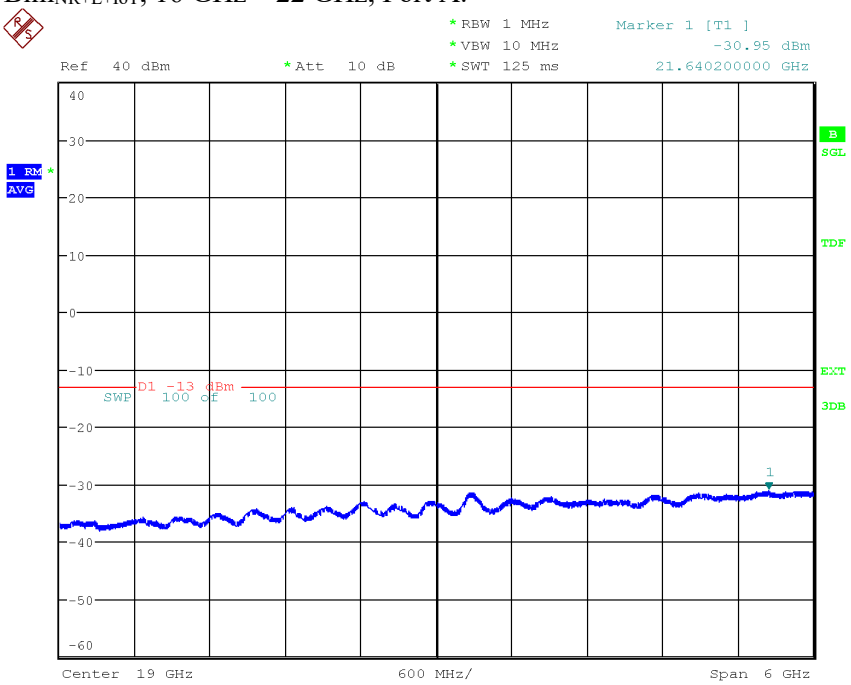
Date: 9.SEP.2020 13:24:56

Diagram 3.7d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:



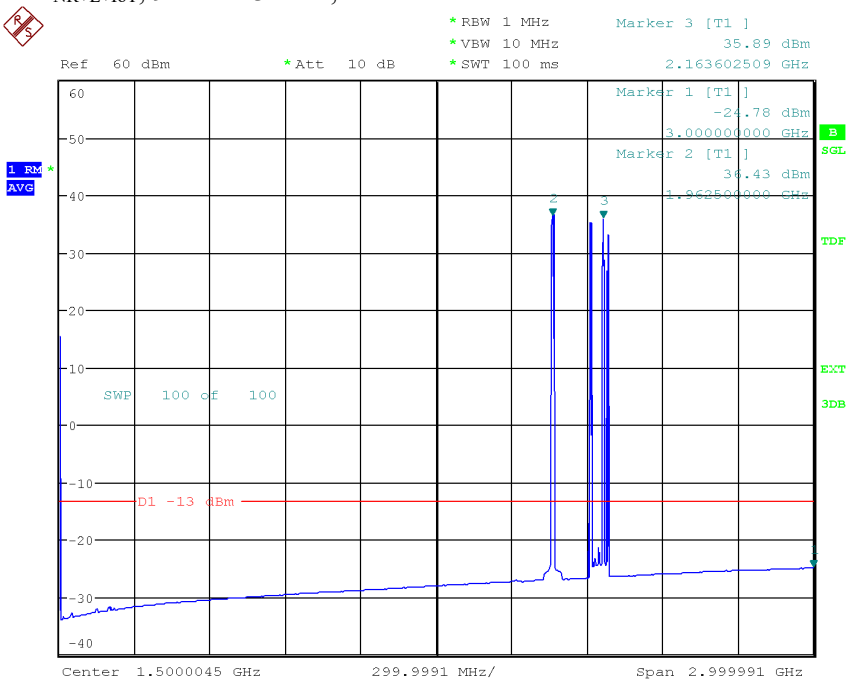
Date: 9.SEP.2020 13:22:25

Diagram 3.7e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Bim_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:



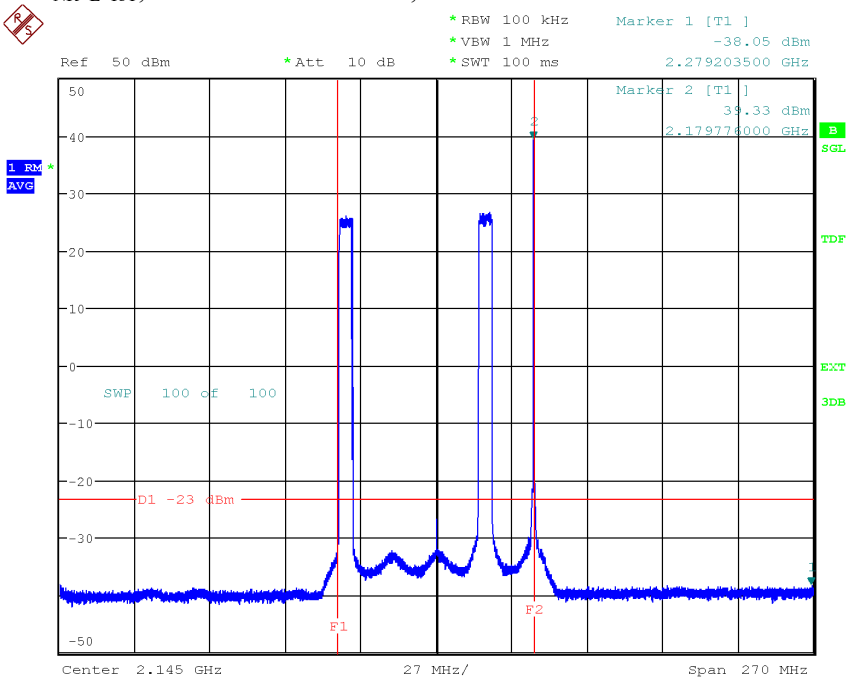
Date: 9.SEP.2020 13:16:21

Diagram 3.8a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



Date: 9.SEP.2020 13:42:18

Diagram 3.8b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 2.01 GHz – 2.28 GHz, Port A:



Date: 23.SEP.2020 12:08:21

Diagram 3.8c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:

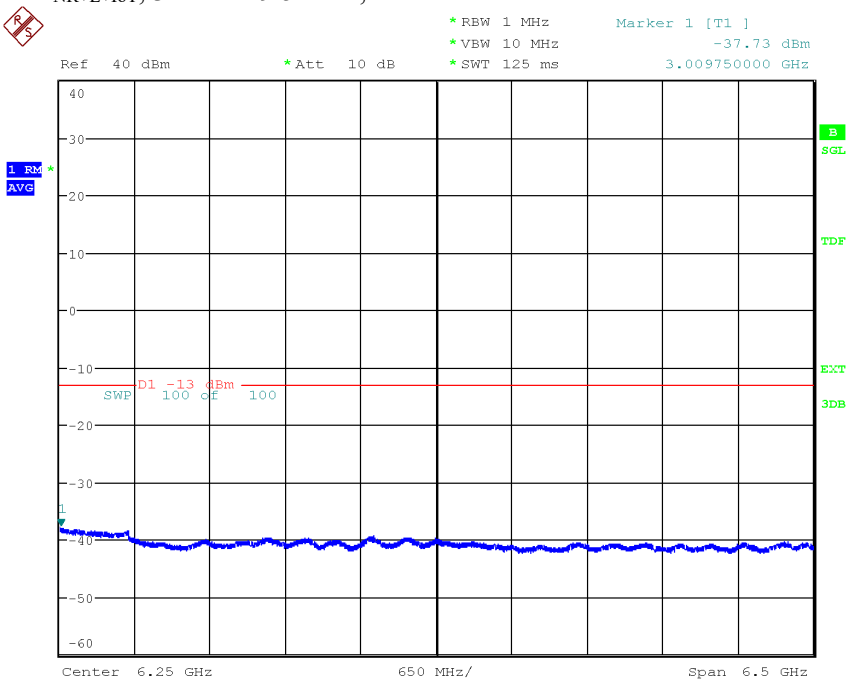


Diagram 3.8d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:

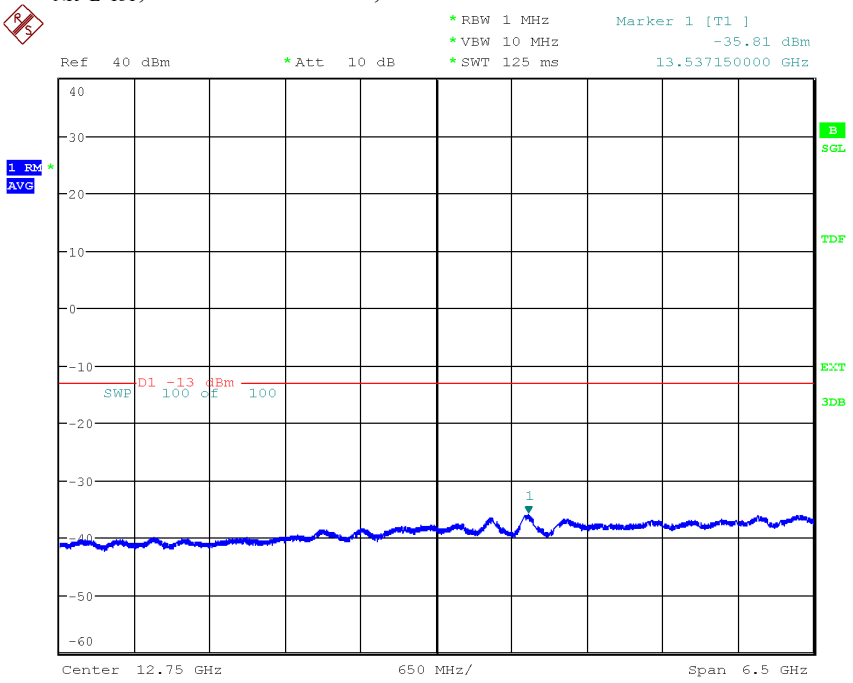
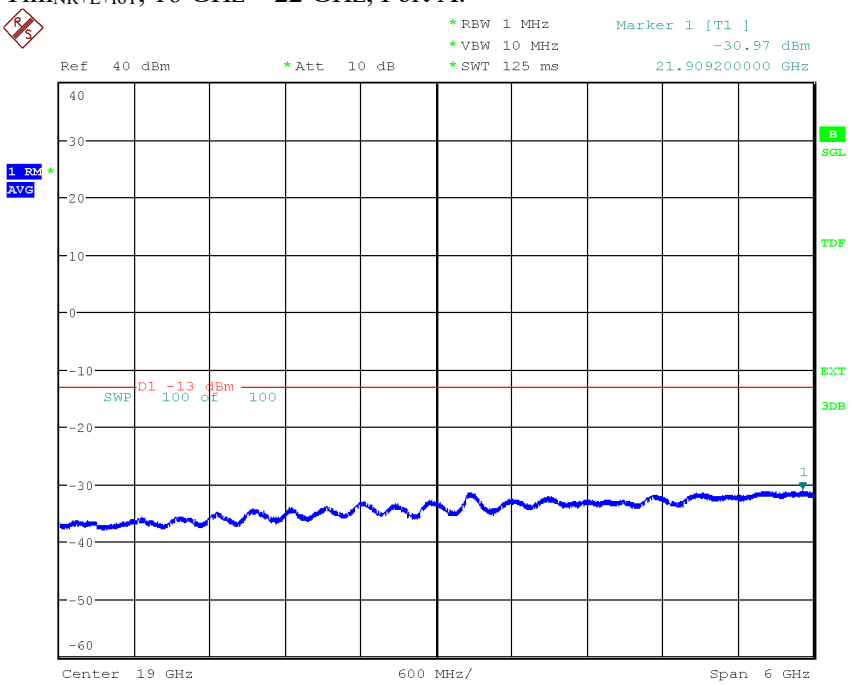
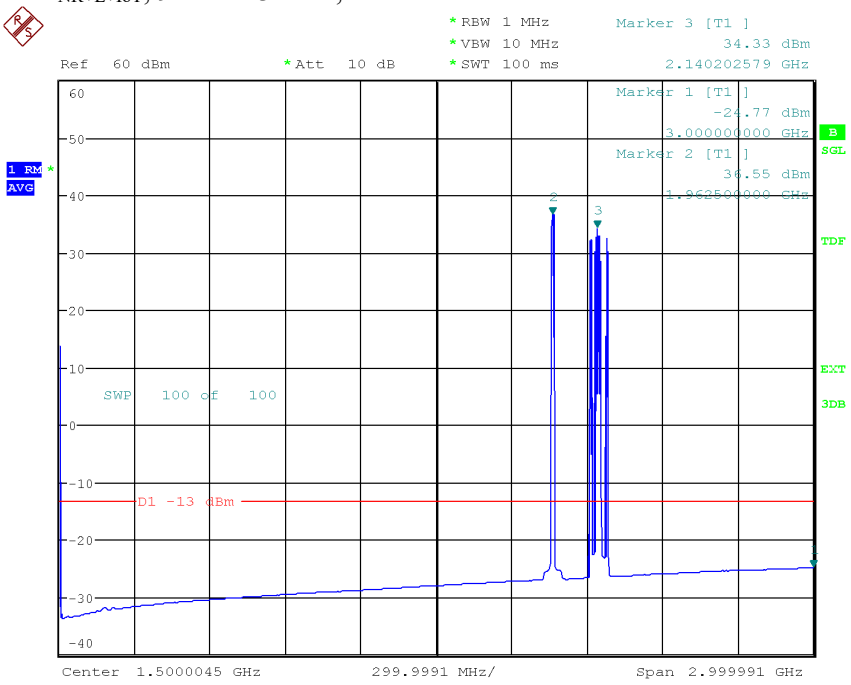


Diagram 3.8e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Tim_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:



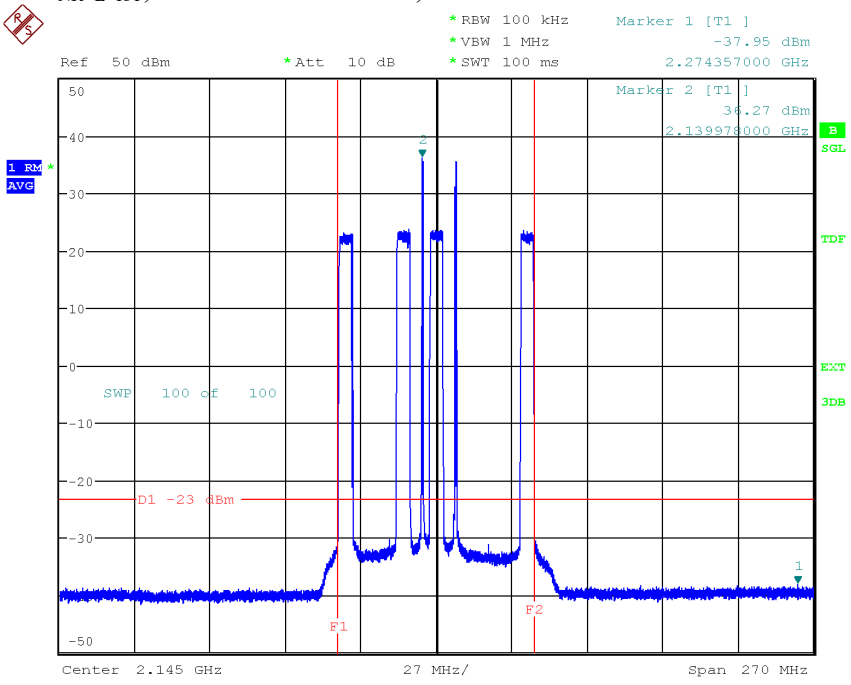
Date: 9.SEP.2020 13:57:56

Diagram 3.9a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 9 kHz – 3 GHz, Port A:



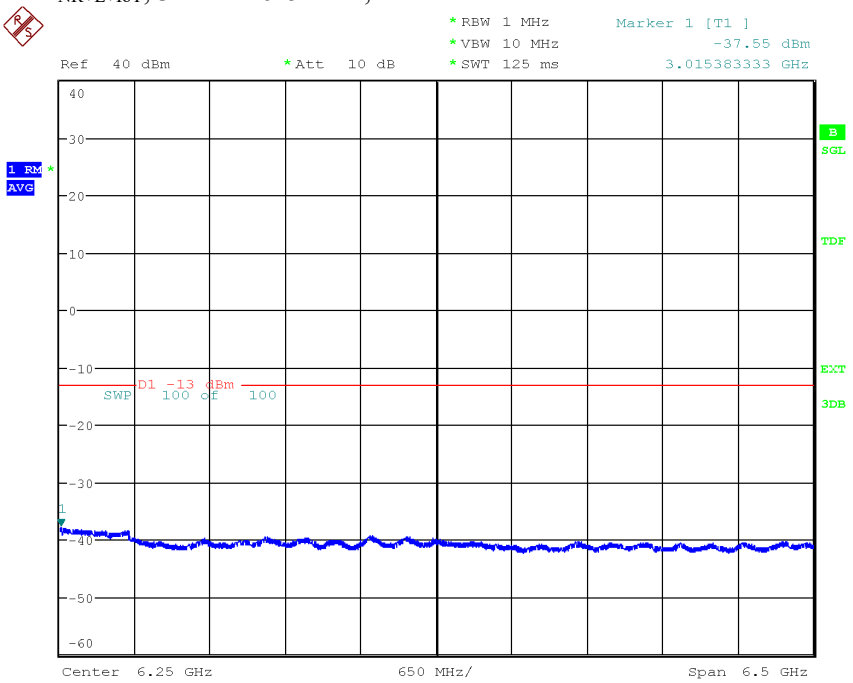
Date: 9.SEP.2020 14:35:24

Diagram 3.9b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 2.01 GHz – 2.28 GHz, Port A:



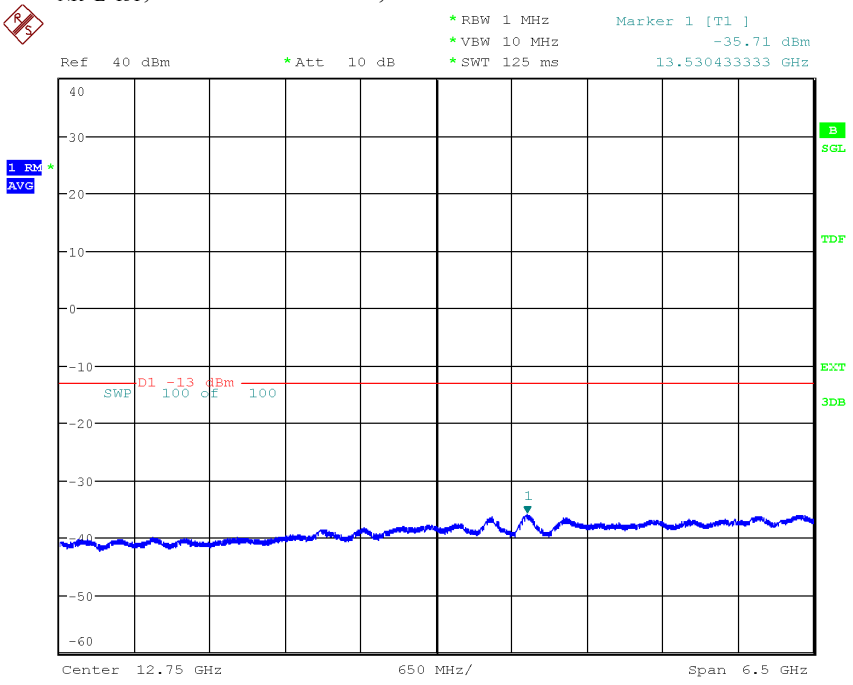
Date: 23.SEP.2020 12:12:55

Diagram 3.9c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 3 GHz – 9.5 GHz, Port A:



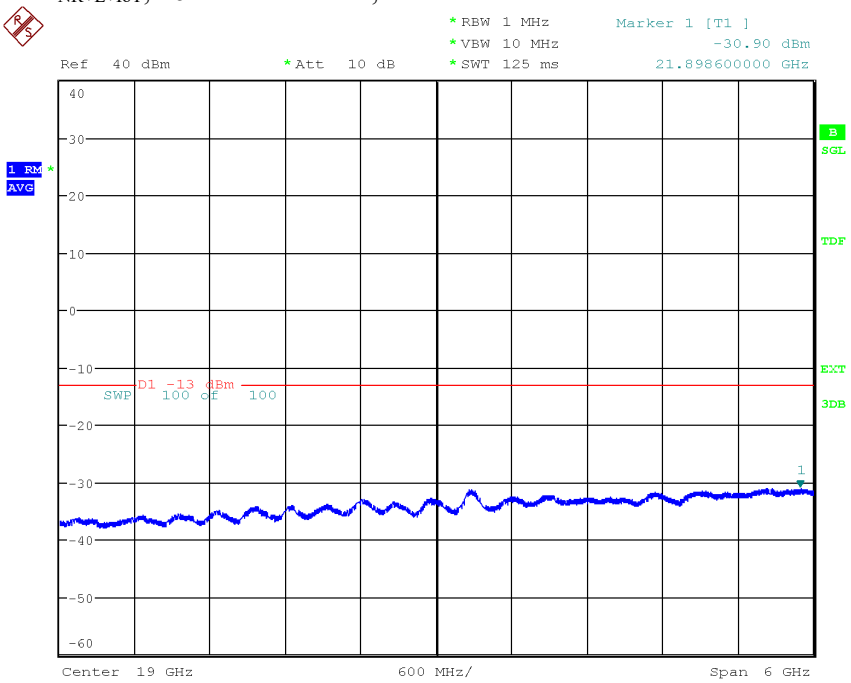
Date: 9.SEP.2020 14:30:13

Diagram 3.9d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 9.5 GHz – 16 GHz, Port A:



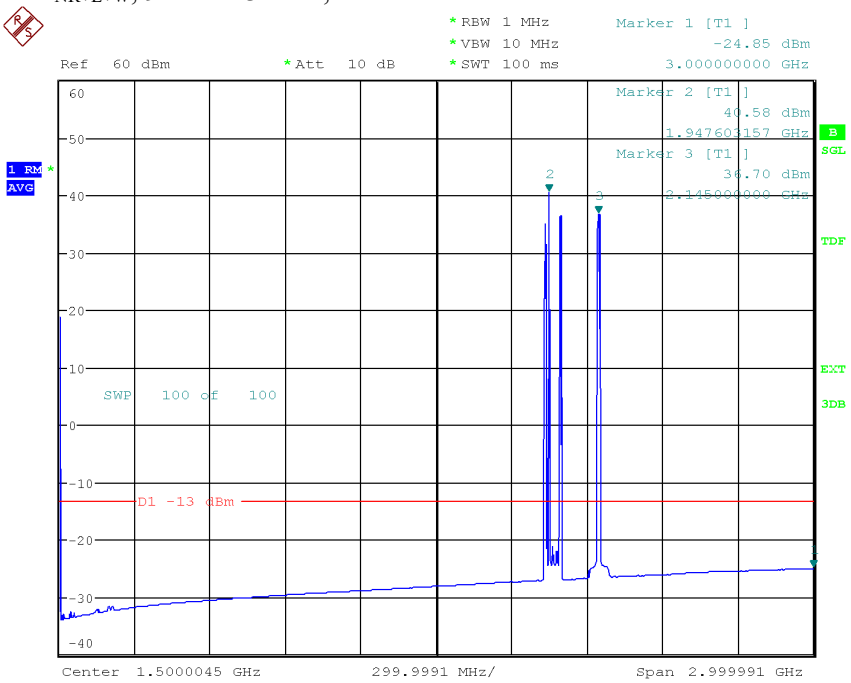
Date: 9.SEP.2020 14:26:07

Diagram 3.9e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, NB IoT SA: N-TM, $Max_{NR+L+IoT}$, 16 GHz – 22 GHz, Port A:



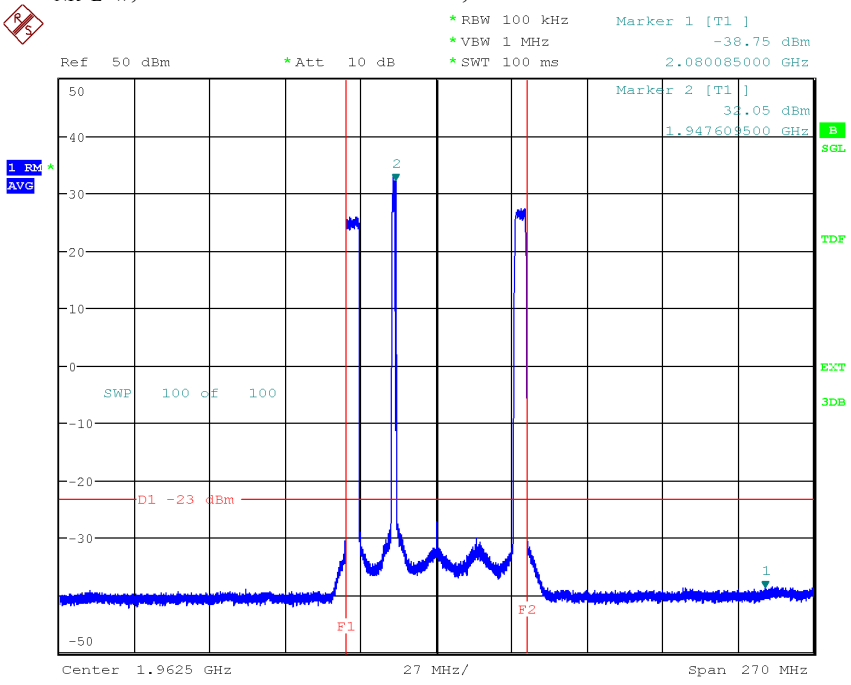
Date: 9.SEP.2020 14:22:43

Diagram 3.10a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 9 kHz – 3 GHz, Port A:



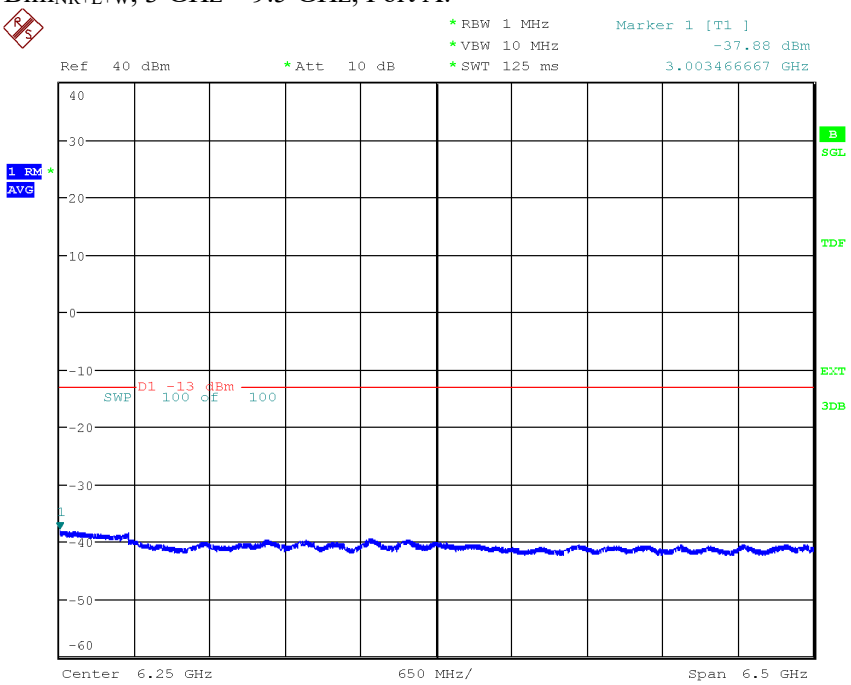
Date: 9.SEP.2020 09:58:32

Diagram 3.10b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 1.8275 GHz – 2.0975 GHz, Port A:



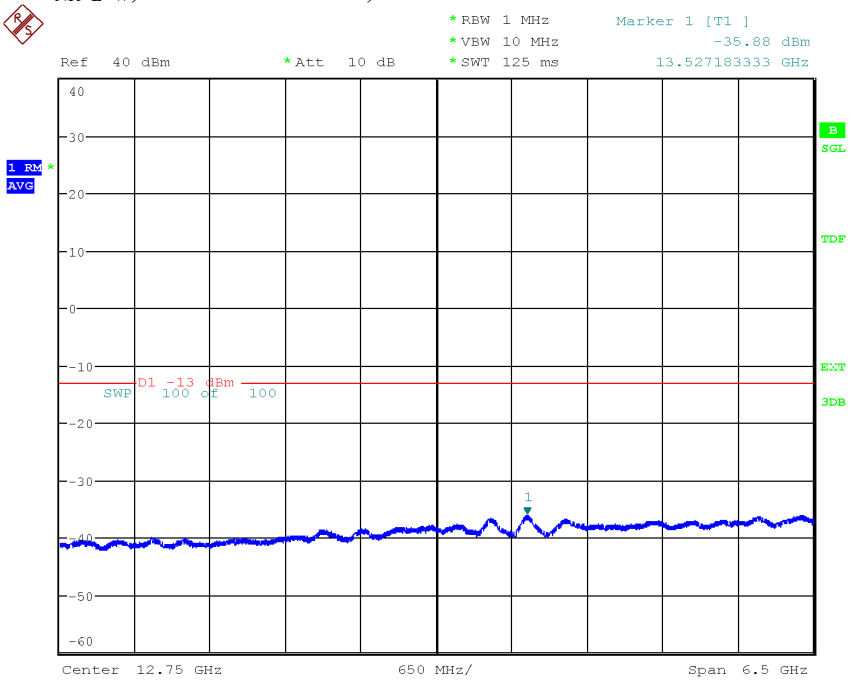
Date: 23.SEP.2020 11:04:35

Diagram 3.10c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



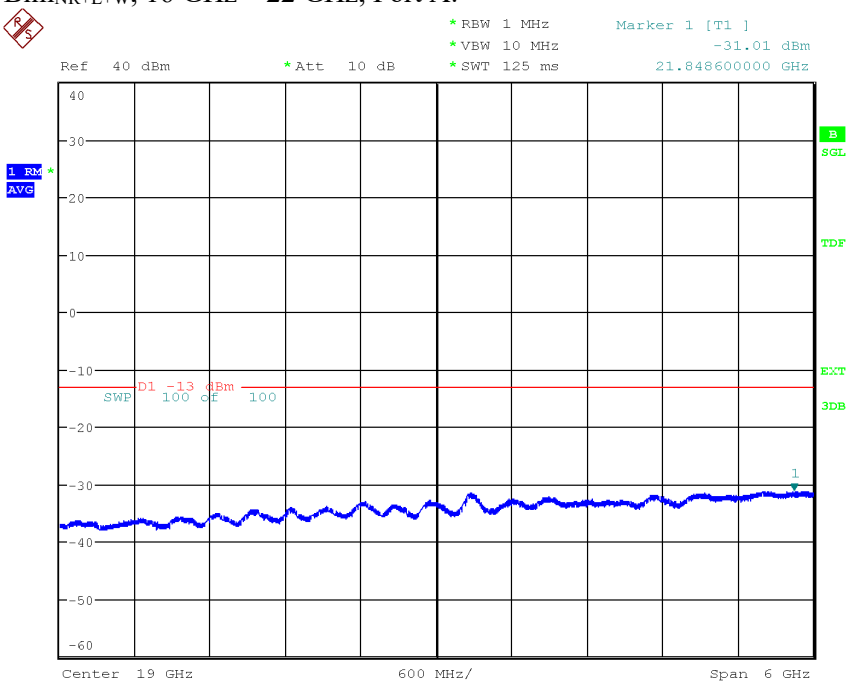
Date: 9.SEP.2020 10:09:21

Diagram 3.10d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



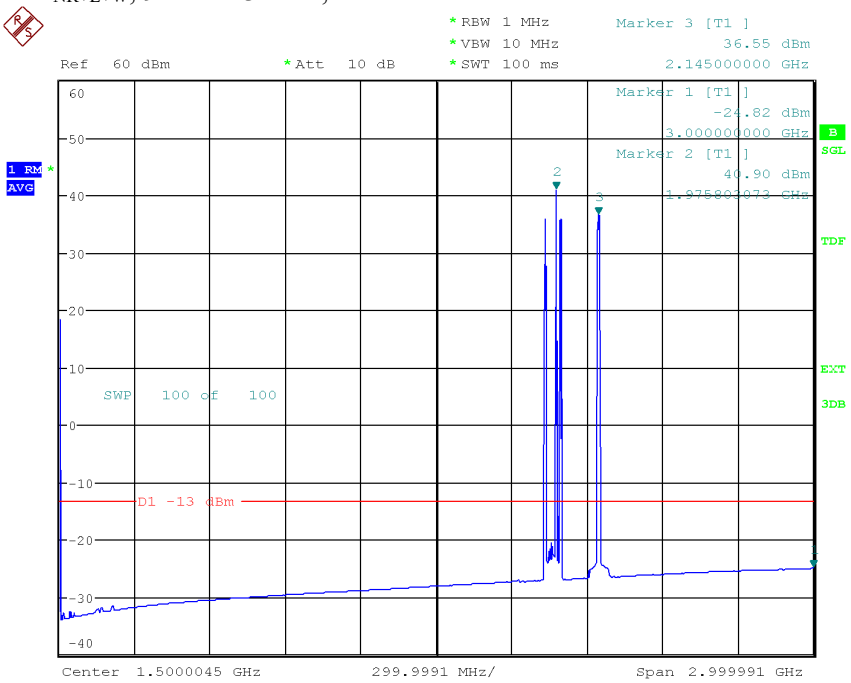
Date: 9.SEP.2020 10:12:01

Diagram 3.10e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 16 GHz – 22 GHz, Port A:



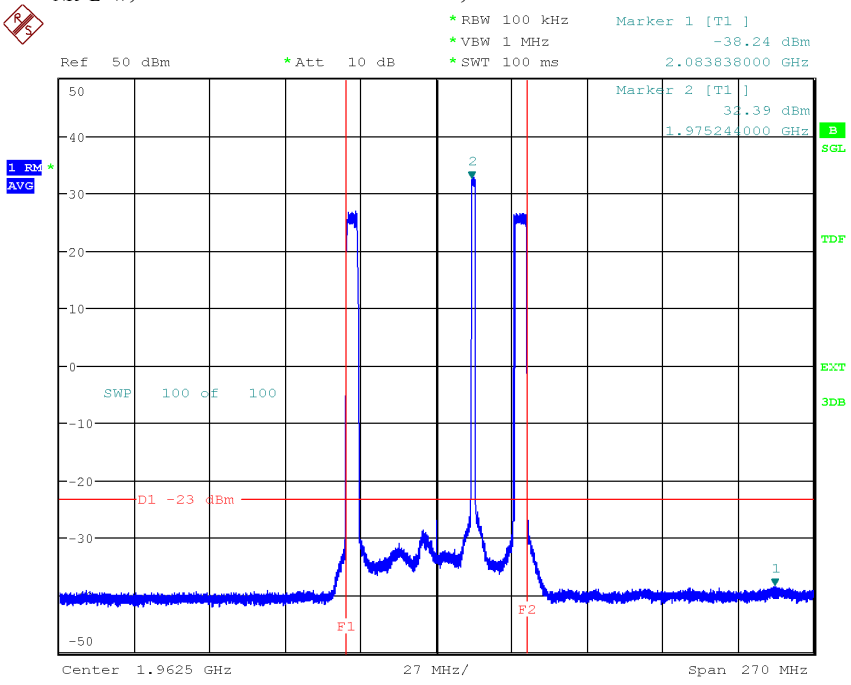
Date: 9.SEP.2020 10:14:29

Diagram 3.11a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 9 kHz – 3 GHz, Port A:



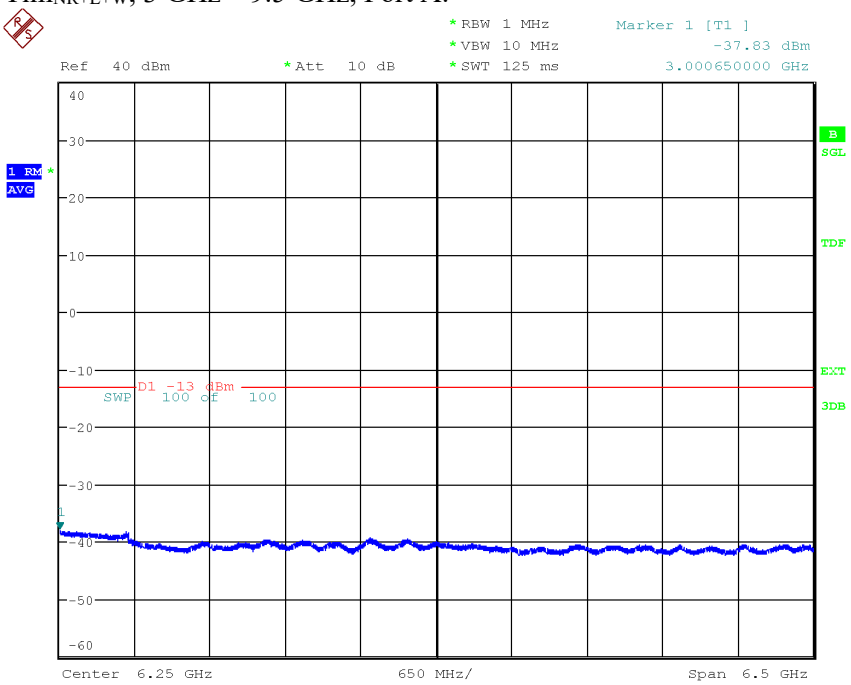
Date: 9.SEP.2020 10:37:30

Diagram 3.11b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 1.8275 GHz – 2.0975 GHz, Port A:



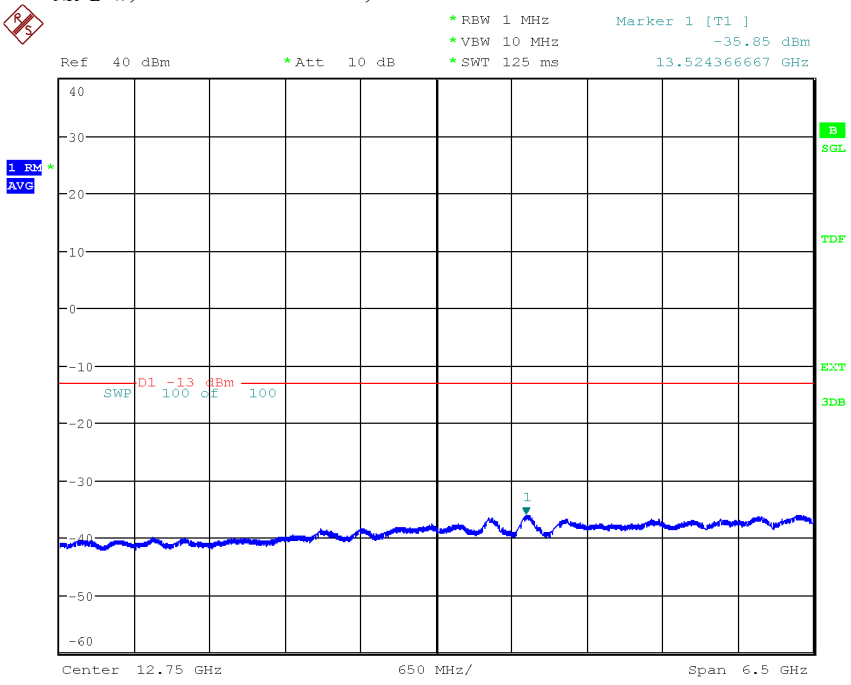
Date: 23.SEP.2020 11:38:00

Diagram 3.11c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



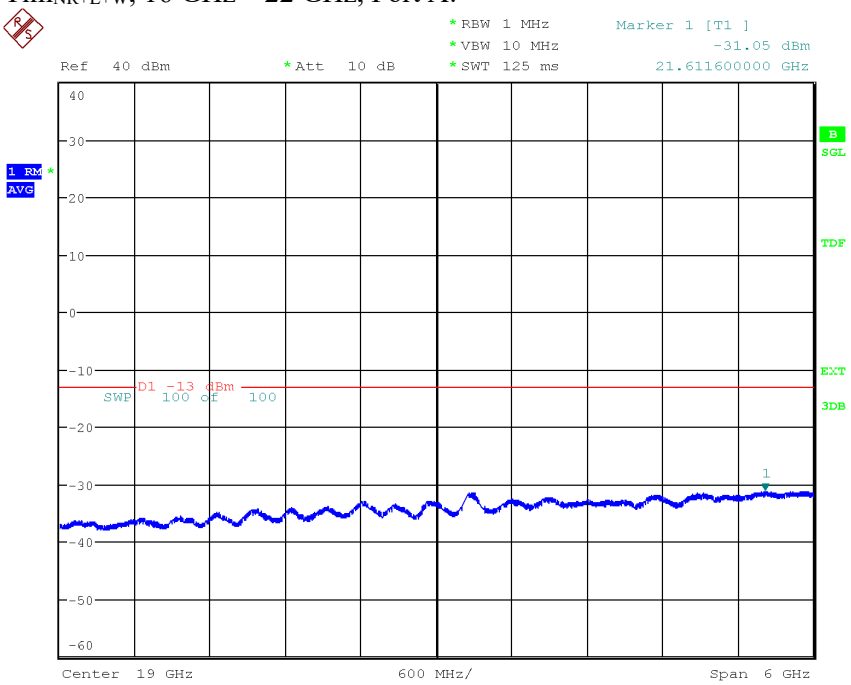
Date: 9.SEP.2020 10:31:38

Diagram 3.11d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



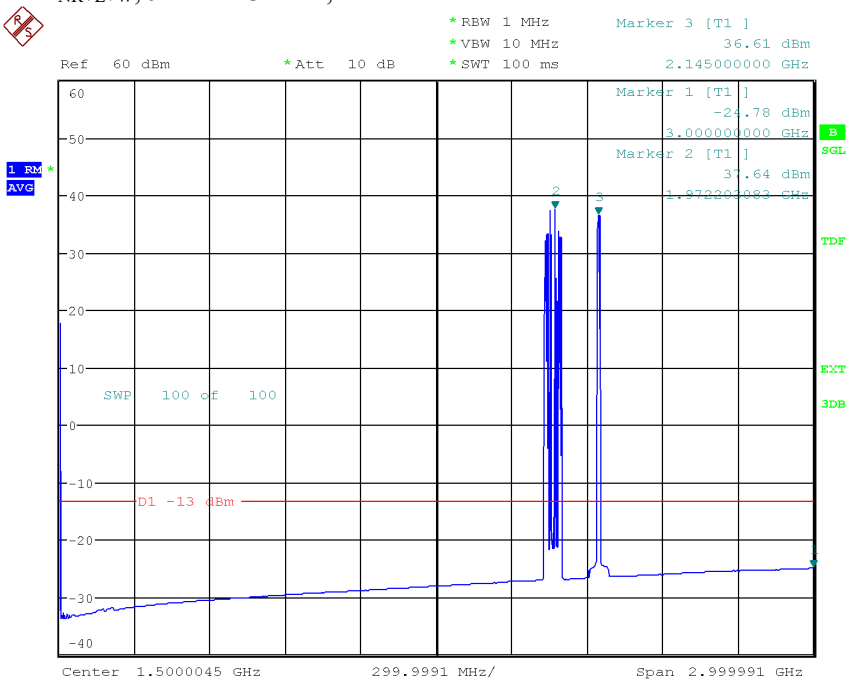
Date: 9.SEP.2020 10:22:28

Diagram 3.11e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 16 GHz – 22 GHz, Port A:



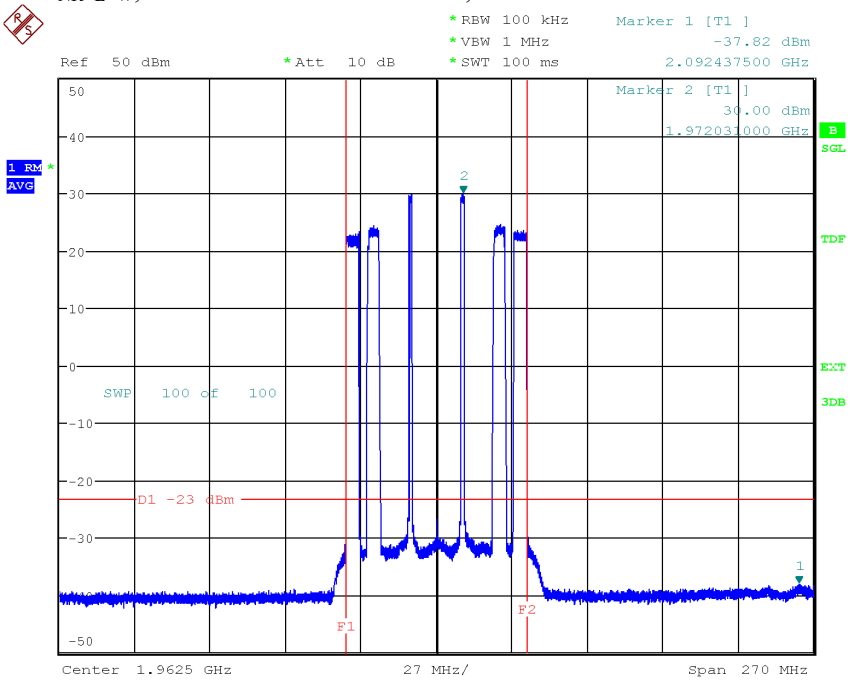
Date: 9.SEP.2020 10:18:48

Diagram 3.12a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 9 kHz – 3 GHz, Port A:



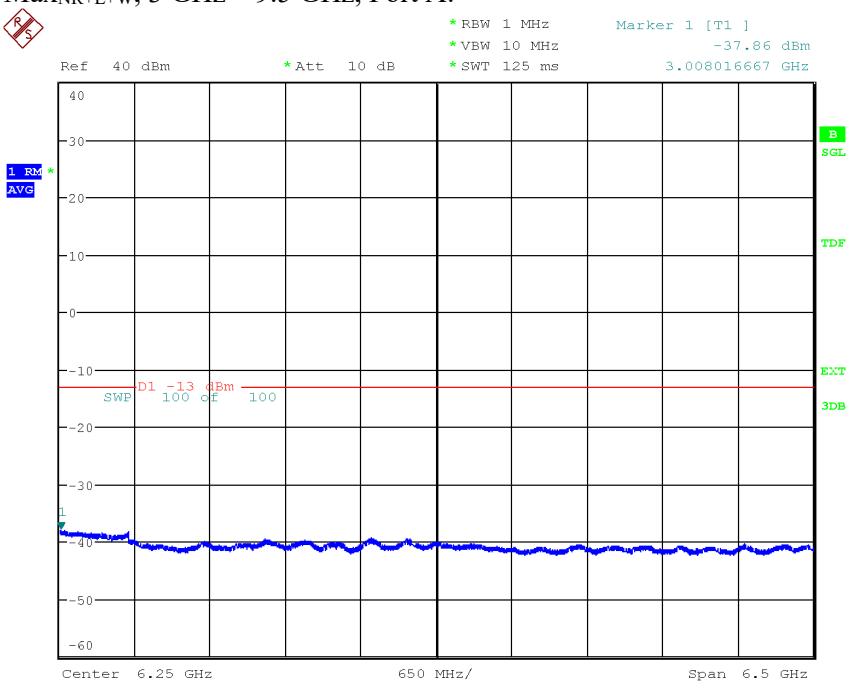
Date: 8.SEP.2020 16:49:57

Diagram 3.12b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 1.8275 GHz – 2.0975 GHz, Port A:



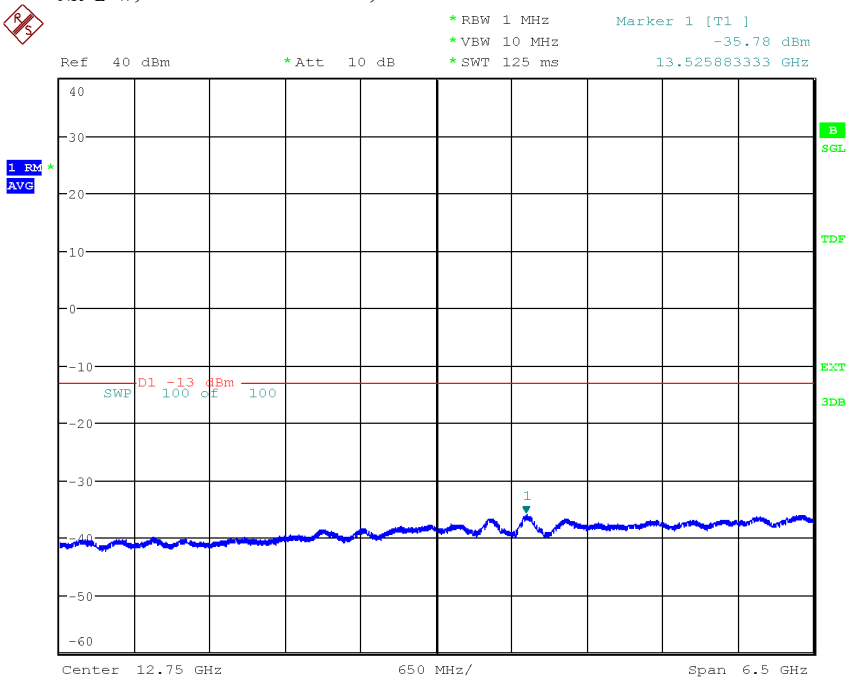
Date: 23.SEP.2020 12:30:28

Diagram 3.12c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



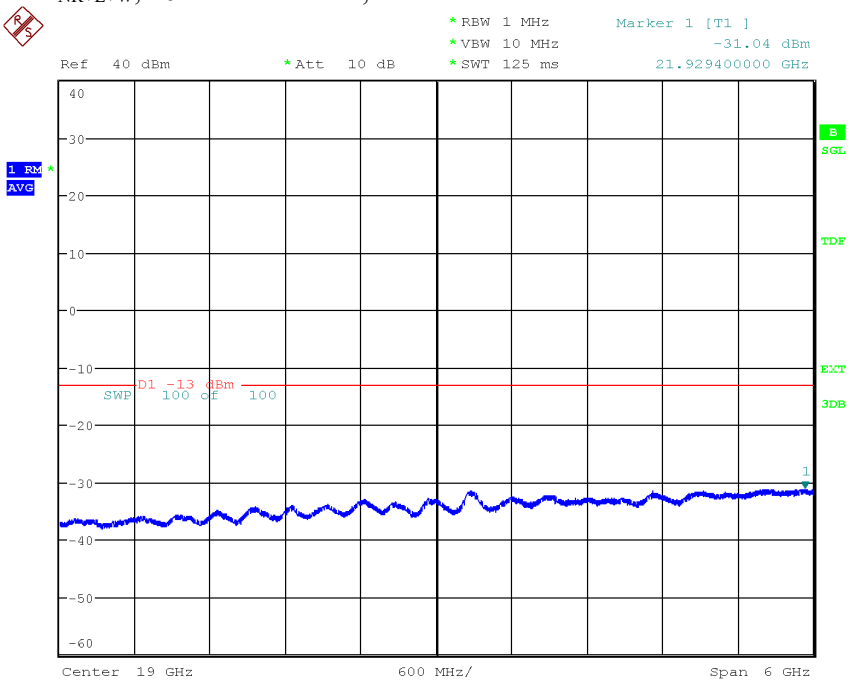
Date: 8.SEP.2020 16:45:59

Diagram 3.12d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



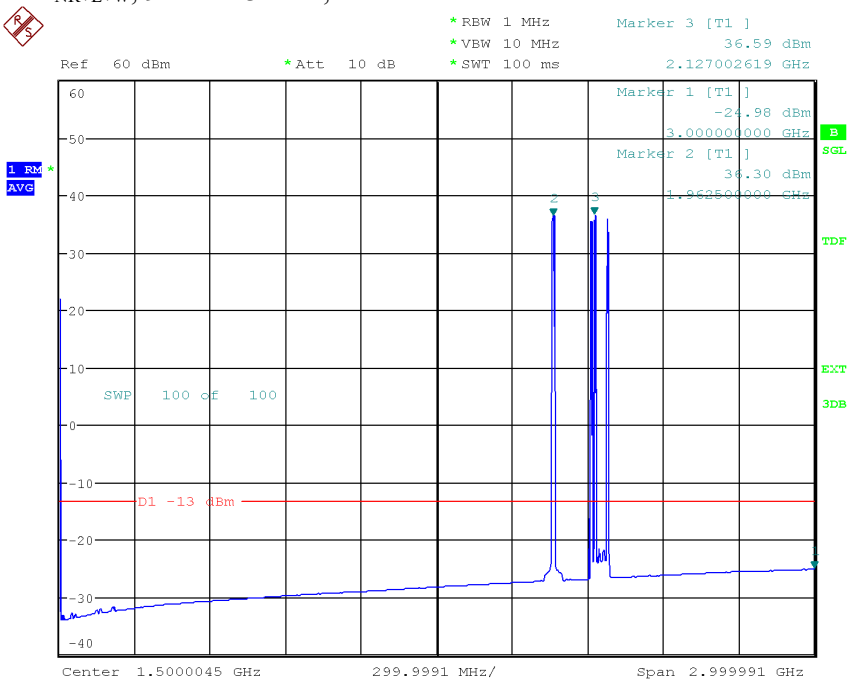
Date: 8.SEP.2020 16:41:48

Diagram 3.12e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 16 GHz – 22 GHz, Port A:



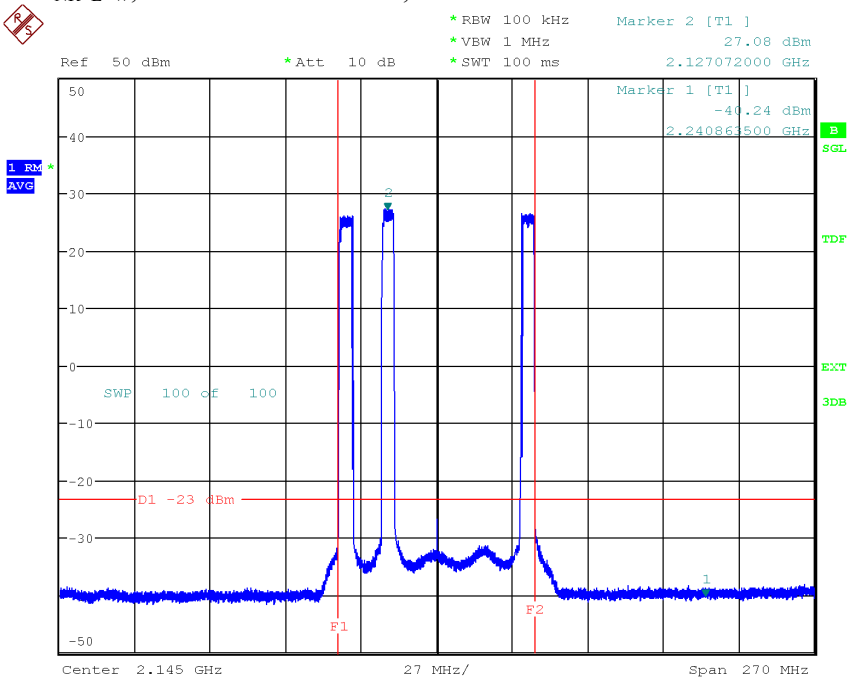
Date: 8.SEP.2020 16:37:58

Diagram 3.13a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 9 kHz – 3 GHz, Port A:



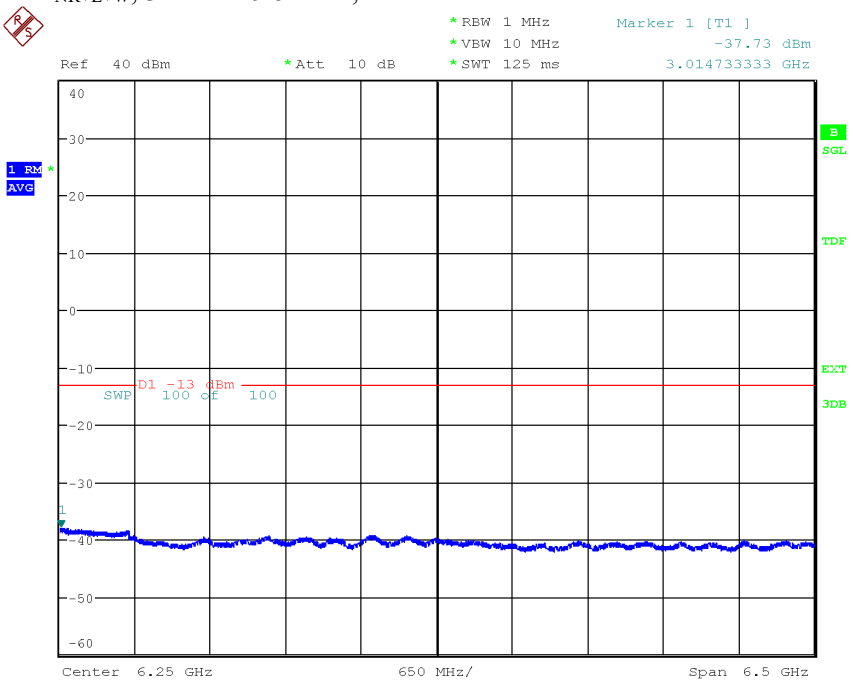
Date: 30.SEP.2020 14:54:15

Diagram 3.13b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 2.01 GHz – 2.28 GHz, Port A:



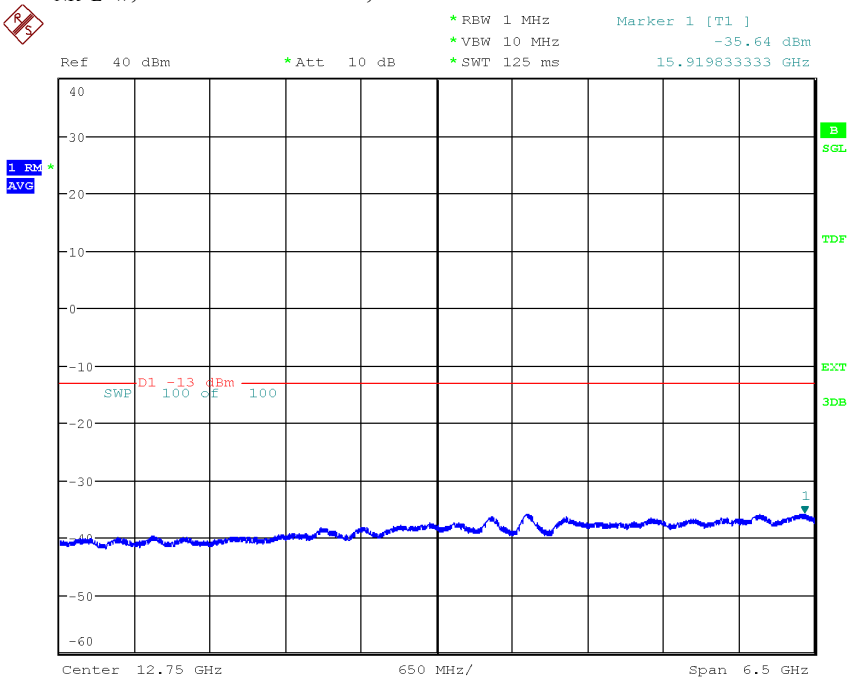
Date: 30.SEP.2020 14:57:42

Diagram 3.13c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



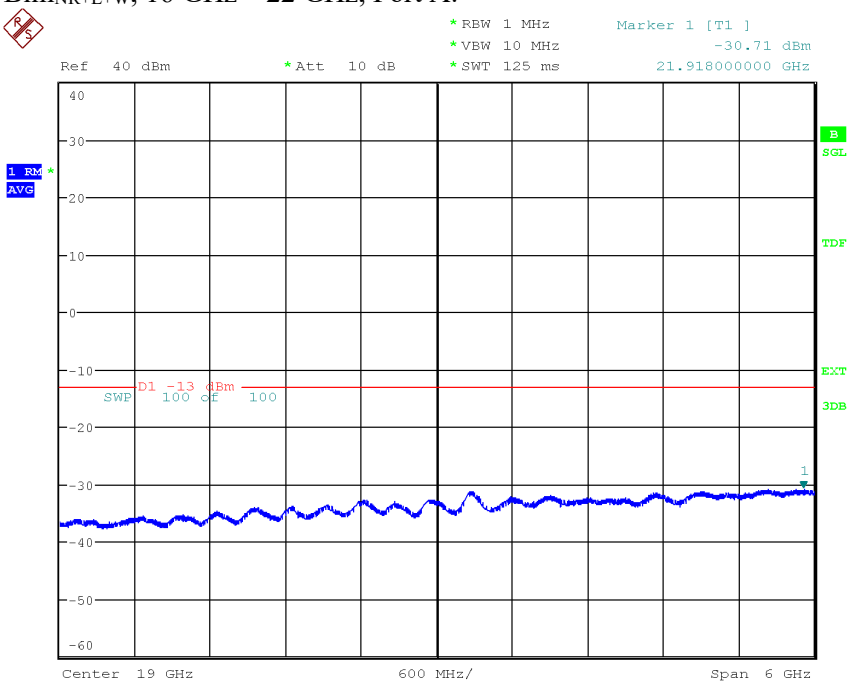
Date: 30.SEP.2020 14:48:03

Diagram 3.13d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



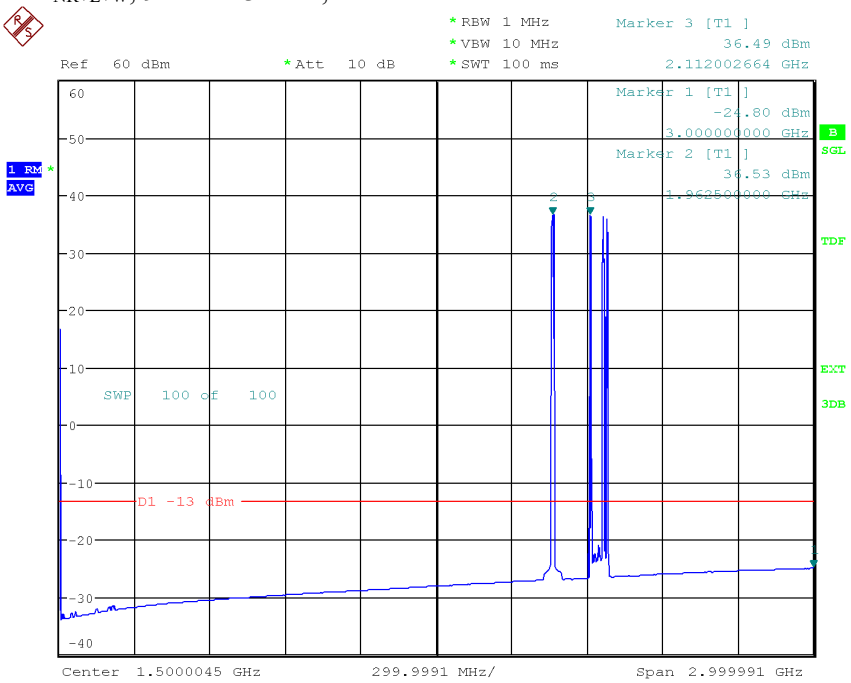
Date: 30.SEP.2020 14:45:08

Diagram 3.13e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Bim_{NR+L+W}, 16 GHz – 22 GHz, Port A:



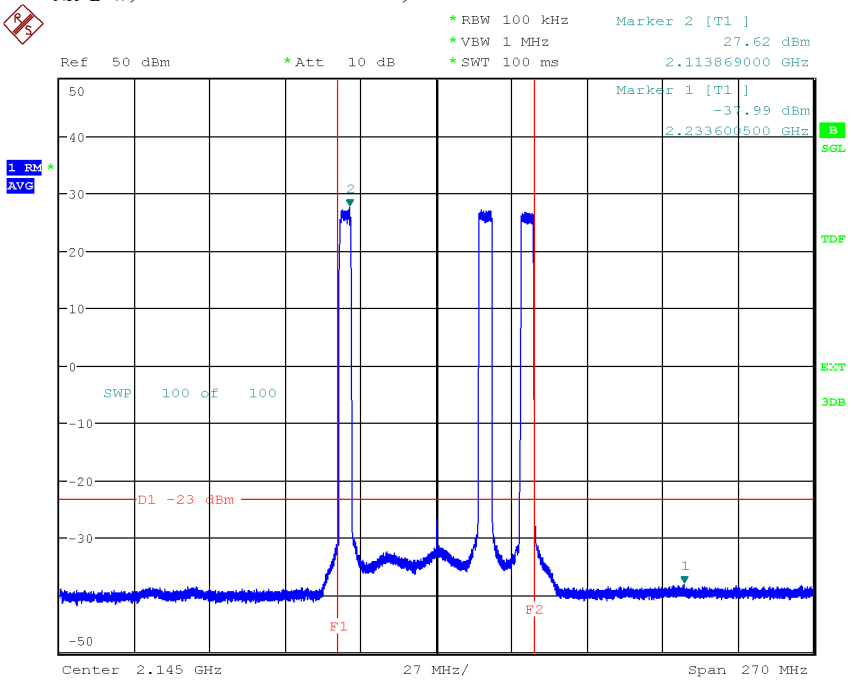
Date: 30.SEP.2020 14:25:04

Diagram 3.14a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 9 kHz – 3 GHz, Port A:



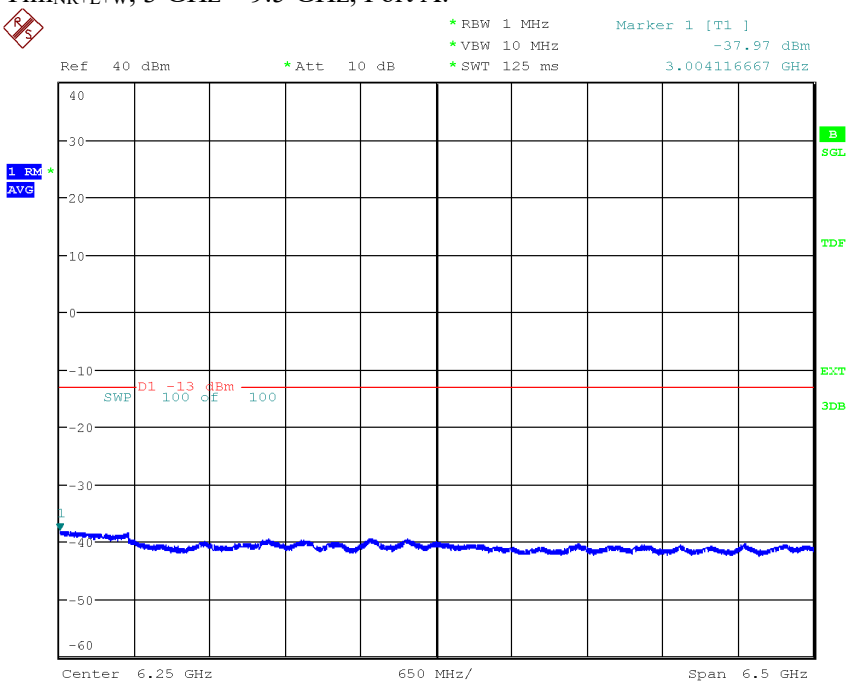
Date: 9.SEP.2020 11:52:28

Diagram 3.14b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 2.01 GHz – 2.28 GHz, Port A:



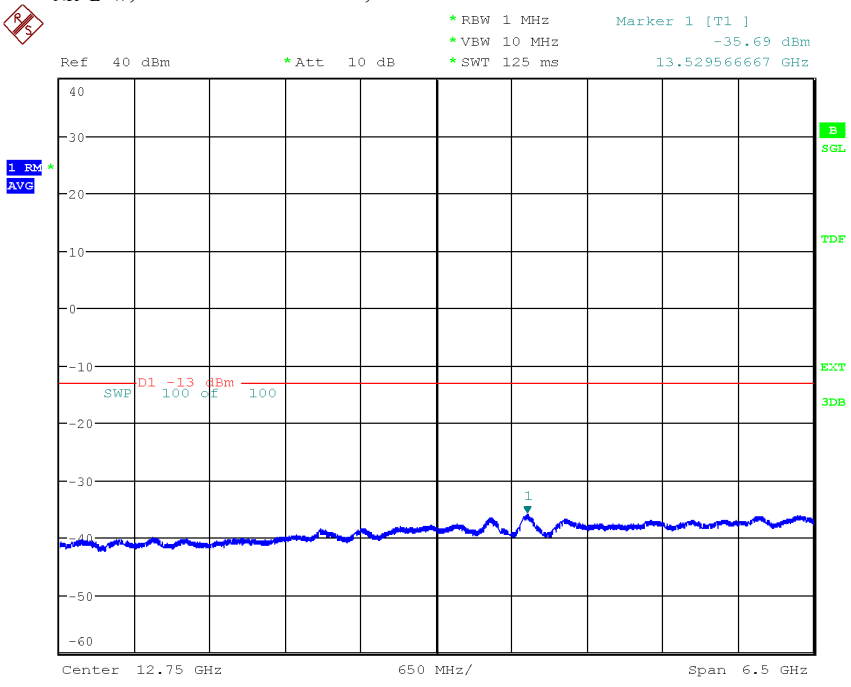
Date: 23.SEP.2020 12:00:22

Diagram 3.14c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



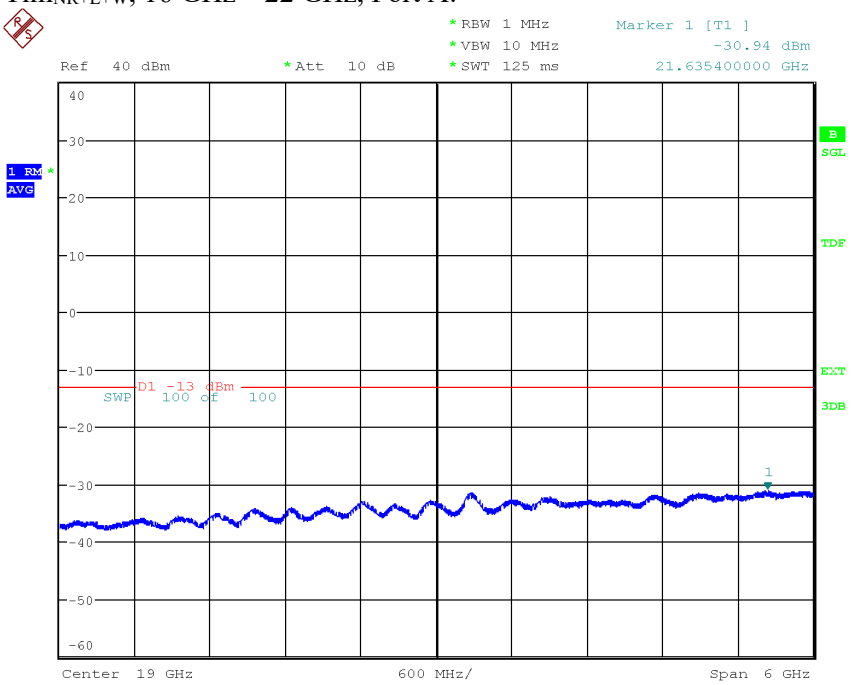
Date: 9.SEP.2020 11:58:23

Diagram 3.14d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



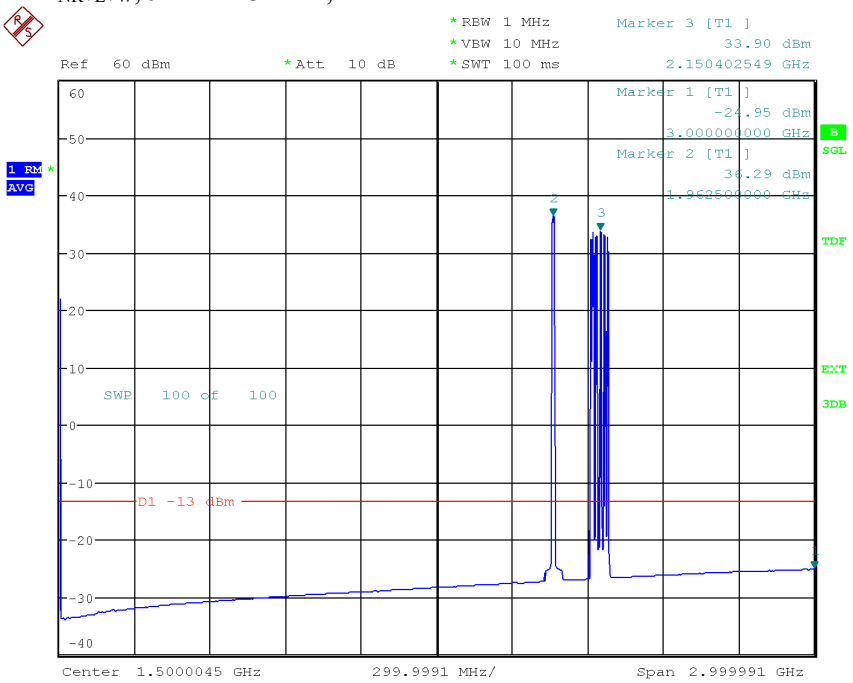
Date: 9.SEP.2020 12:00:58

Diagram 3.14e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Tim_{NR+L+W}, 16 GHz – 22 GHz, Port A:



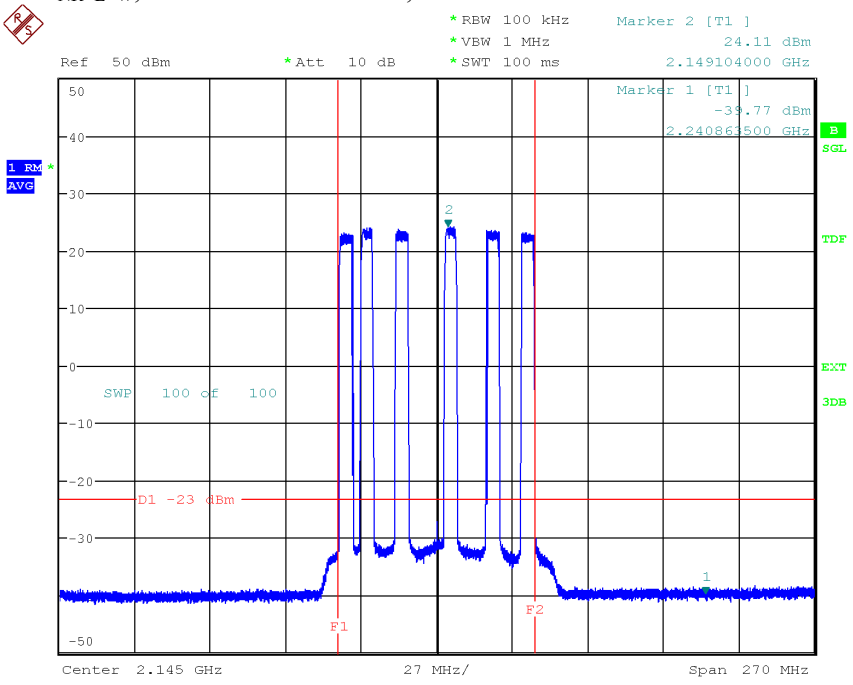
Date: 9.SEP.2020 12:03:02

Diagram 3.15a, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 9 kHz – 3 GHz, Port A:



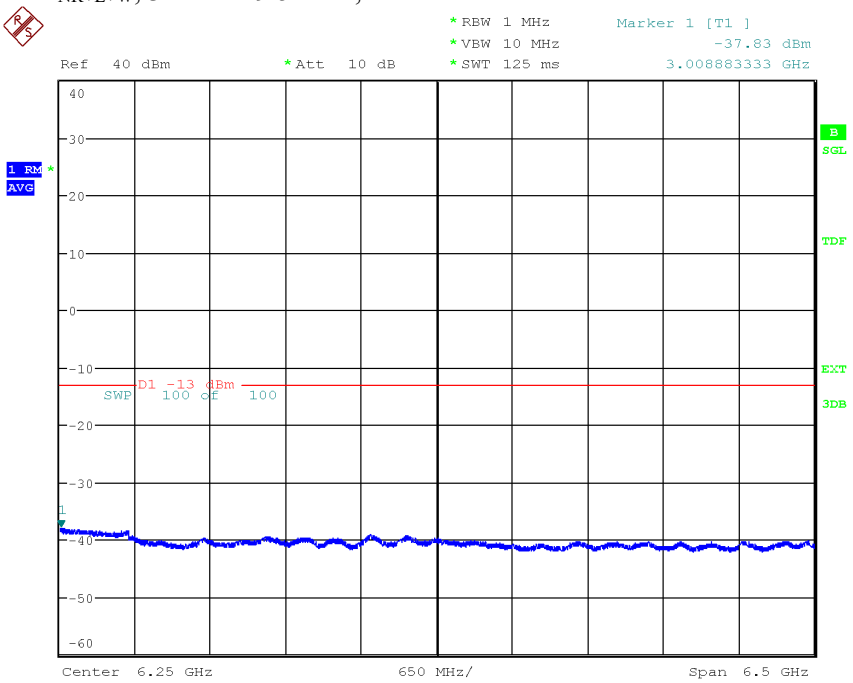
Date: 30.SEP.2020 13:58:34

Diagram 3.15b, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 2.01 GHz – 2.28 GHz, Port A:



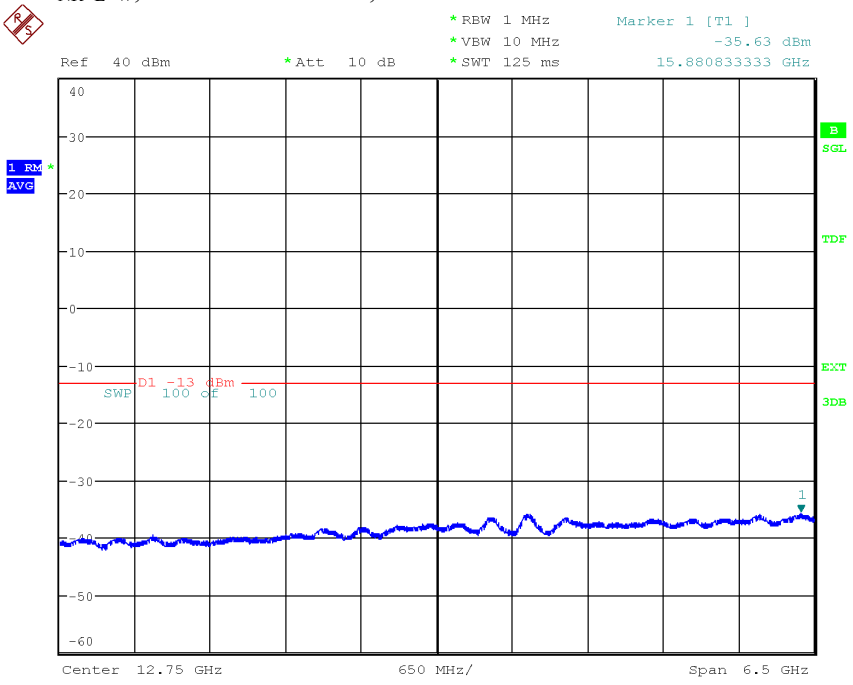
Date: 30.SEP.2020 14:01:14

Diagram 3.15c, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 3 GHz – 9.5 GHz, Port A:



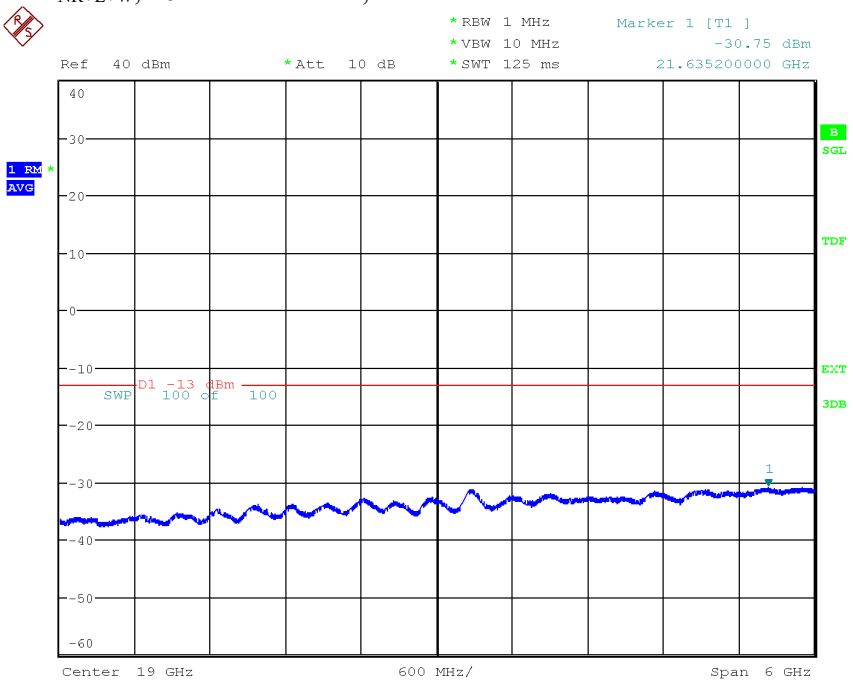
Date: 30.SEP.2020 14:05:16

Diagram 3.15d, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 9.5 GHz – 16 GHz, Port A:



Date: 30.SEP.2020 14:08:14

Diagram 3.15e, NR: NR-FR1-TM1.1, LTE: E-TM1.1, WCDMA: TM1, Max_{NR+L+W}, 16 GHz – 22 GHz, Port A:



Date: 30.SEP.2020 14:14:36

Field strength of spurious radiation measurements according to CFR 47 §24.238 and §27.53(h) / RSS-133 6.5, RSS-139 6.6

Date	Temperature	Humidity
2020-08-31	22 °C ± 3 °C	34 % ± 5 %
2020-09-01	23 °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 and test object height in the different frequency ranges can been seen below.

The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1 m in the frequency range 18 GHz – 22 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 – 22 GHz.

The measurement was performed with an RBW of 1 MHz.

A propagation loss in free space was calculated. The used formula was

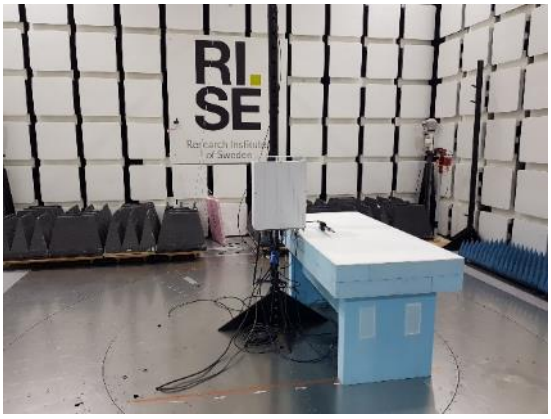
$\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

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.

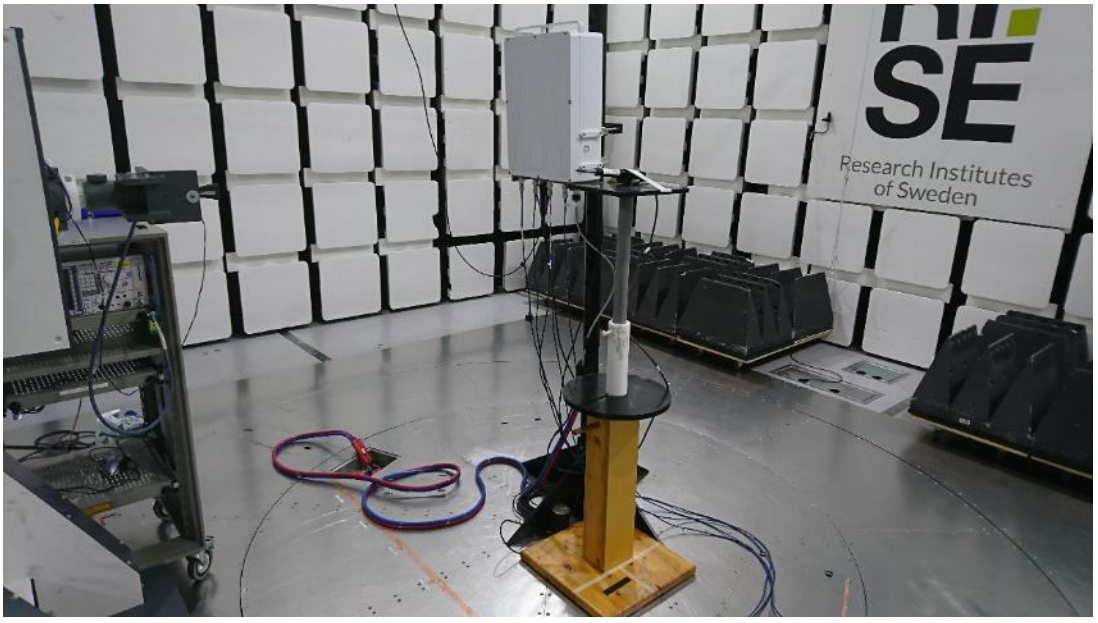
The test set-up during the spurious radiation measurements is shown in the pictures below (principle pictures):

Test setup 30-1000 MHz:



Test setup 1-18 GHz:

Test setup 18-22 GHz:



Measurement equipment

Measurement equipment	RISE number
Semi anechoic chamber Tesla	503 881
Rohde & Schwarz ESU 40	901 553
EMC 32 ver. 10.60	BX62351
Coaxial cable, Tesla emission	BX91490
Coaxial cable	503 508
Coaxial cable	503 509
Teseq CBL6143A BiLog antenna	BX92331
EMCO Horn Antenna 3115	502 175
Coaxial cable	503 697
Flann STD Gain Horn Antenna 20240-20	BX92412
µComp Nordic, Low Noise Amplifier	901 545
Miteq, Low Noise Amplifier 18-40 GHz	503 278
HP Filter 3-18 GHz	BX40074
Temperature and humidity meter, Testo 625	504 188

Test frequencies

Symbolic name:

MT_{L+G+W}
BT_{W}
MT_{L+W}
T_{NR+L}
B_{NR+L}
BMT_{MAX}

Results

representing worst case:

Symbolic name BMT_{MAX}, Diagram 2.1a-d

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty: 3.1 dB

Limits

CFR 47 §24.238 and §27.53(h)

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}$ (P) dB. resulting in a limit of -13 dBm.

Complies?	Yes

Diagram 2.1a:

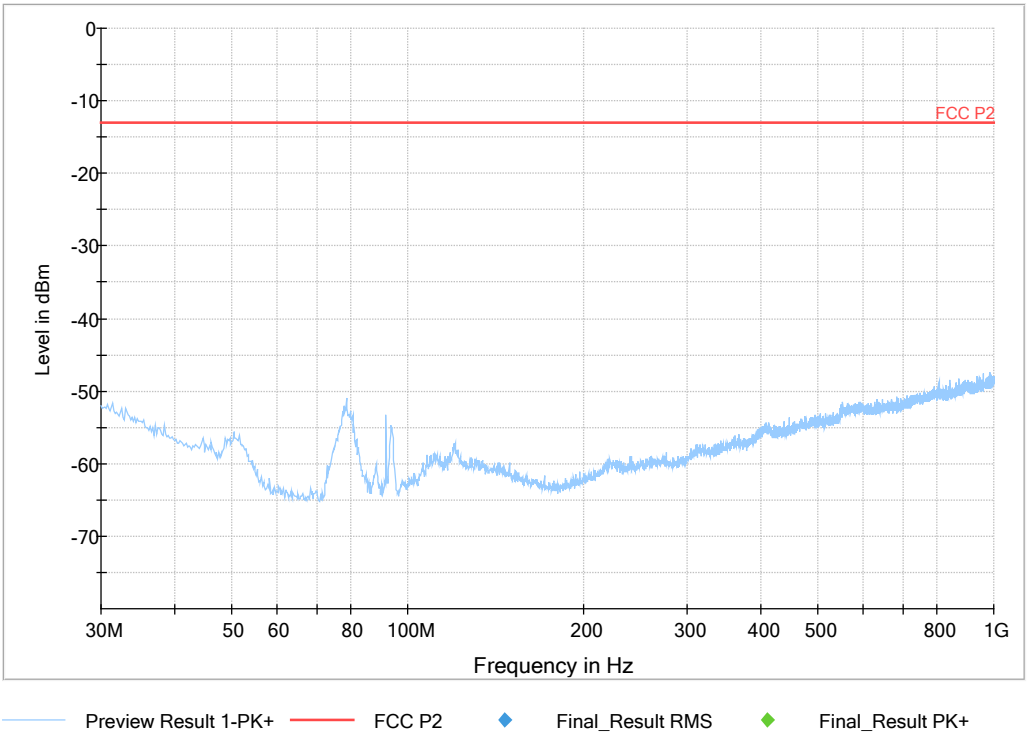
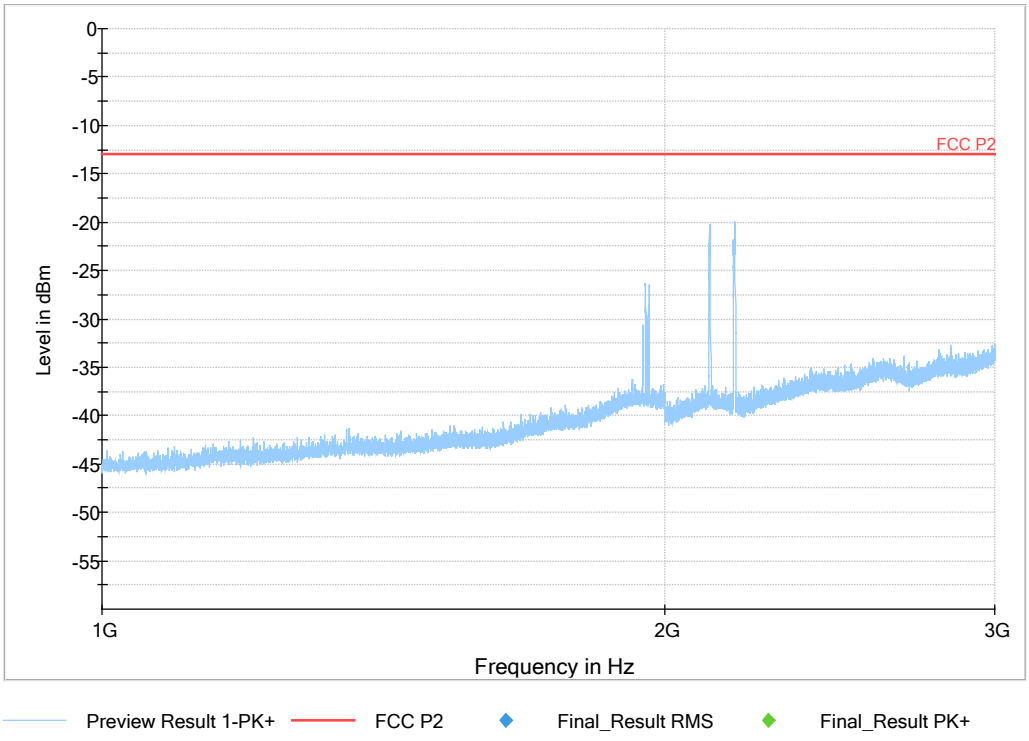


Diagram 2.1b:



Note: The emissions between 1930 – 1995 MHz and between 2110 – 2180 MHz are the carrier frequencies and shall be ignored in the context.

Diagram 2.1c:

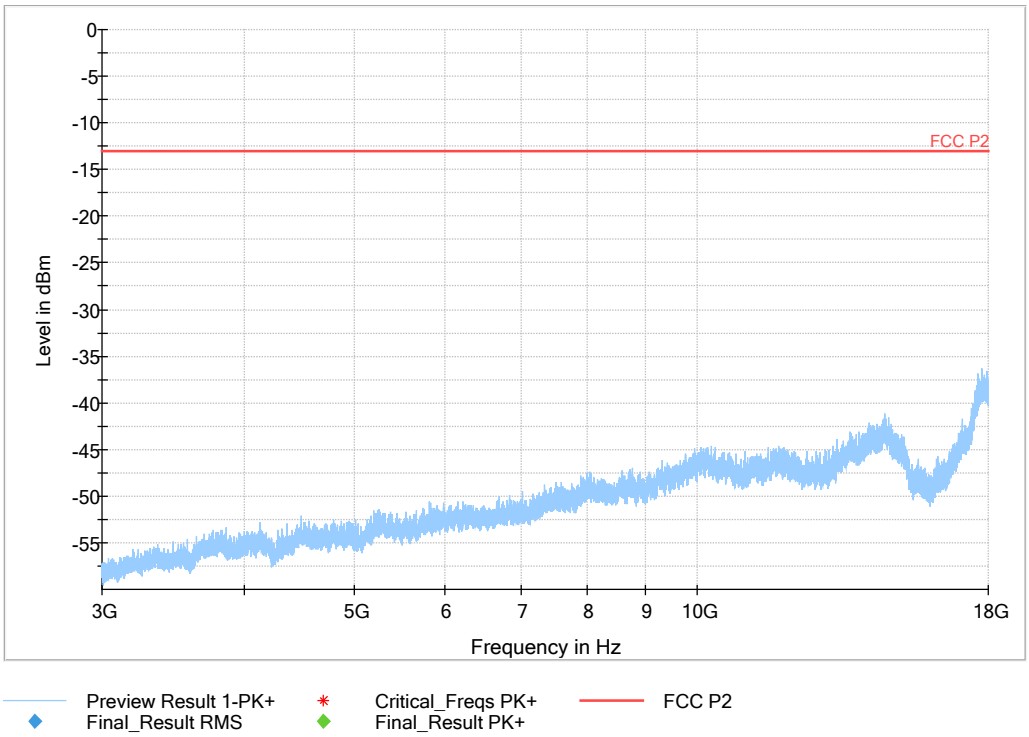
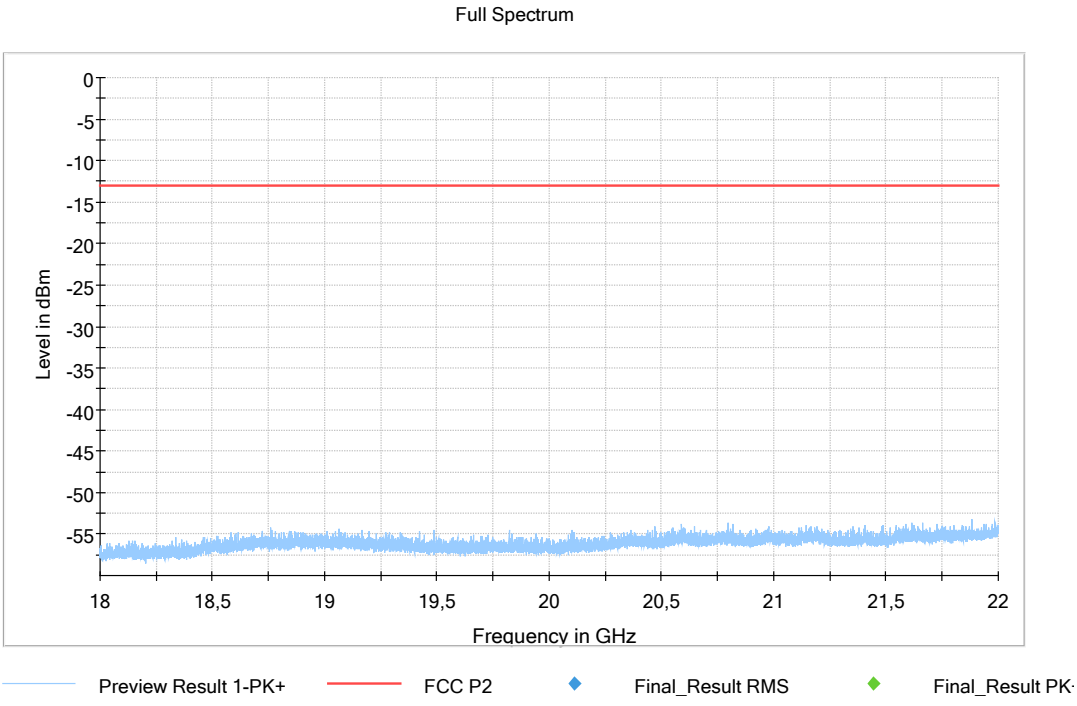


Diagram 2.1d:



Frequency stability measurements according to CFR 47 §24.235 and §27.54 / RSS-133 6.3 and IC RSS-139 6.4

Date	Temperature (test equipment)	Humidity (test equipment)
2020-09-11	24 °C ± 3 °C	25 % ± 5 %

Test set-up and procedure

The measurements were made per RSS 133, 6.3 and RSS 139, 6.4. Using a resolution bandwidth of 1% of the emission bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 $\log_{10}$ P (watts) (i.e. -13 dBm) (for 4x 4MIMO -19 dBm) at the band edge of the lowest and highest channel was selected, and the frequency at these points was recorded as fL and fH respectively.

Measurement equipment	RISE number
R&S FSW 43	902 073
Directional coupler	901 496
RF attenuator	902 282
Coaxial cable Megaphase	BX50191
Coaxial cable Sucoflex 102EA	BX50237
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

B25

Rated output power level at connector RF A (maximum): 47.8 dBm

Test conditions			Frequency margin to band edge at -19 dBm	
			Symbolic name: $B10_{NR}$	Symbolic name: $T10_{NR}$
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth [MHz]	fL [kHz]	fH [kHz]
-48.0	+50	10	7	16

B66

Rated output power level at connector RF A (maximum): 47.8 dBm

Test conditions			Frequency margin to band edge at -19 dBm	
			Symbolic name: $B10_{NR}$	Symbolic name: $T10_{NR}$
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth [MHz]	fL [kHz]	fH [kHz]
-48.0	+50	10	4	14.5

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

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

CFR 47 §24.235 and §27.54 / RSS-133 6.3 and RSS-139 6.4

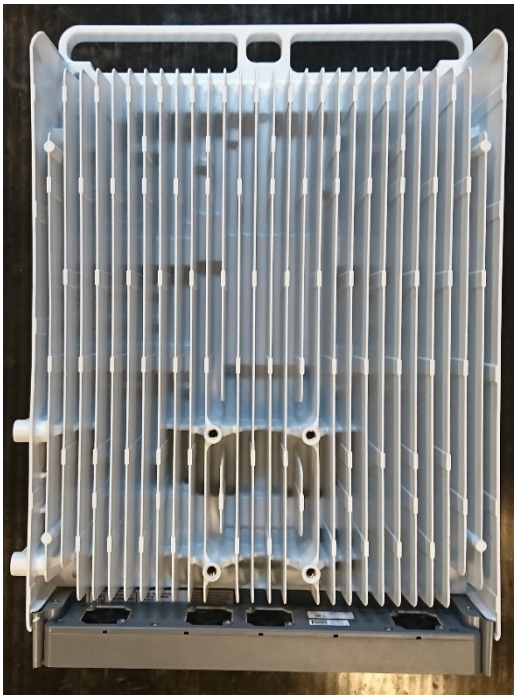
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Complies?	Yes

Photos of test object

Front side

Rear side



Left side

Right side

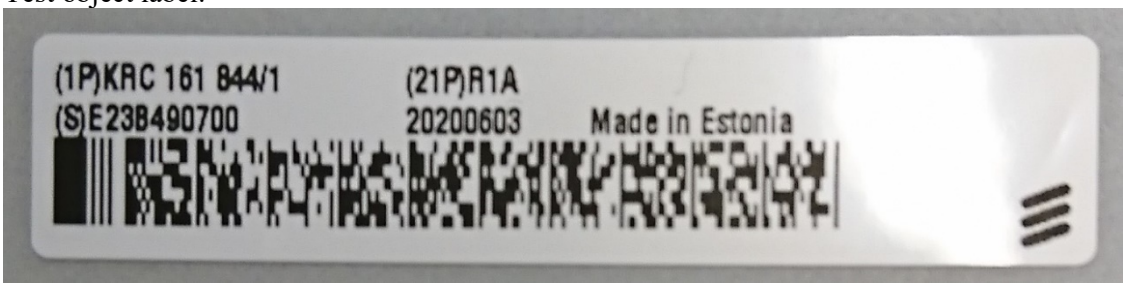
Top side

Bottom side

Labels:

Conducted and radiated measurements:

Test object label:



SFP module Data 1:

SFP module Data 2:

End of report.