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RADIO TEST REPORT – 447842-1TRFWL

Type of assessment:

Final product testing

Applicant:

Redline Communications

Product:

LTE Base Station – Band 41

Model:

Ellipse 4G HP Band 41

FCC ID:

QC8-B41

Specifications:

FCC 47 CFR Part 27

Date of issue: September 15, 2021

Andrey Adelberg, Senior EMC/RF Specialist
Tested by

Signature

Mark Libbrecht, EMC/RF Specialist
Reviewed by

Signature

Company name	Nemko Canada Inc.			
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Test site registration	**Organization**	**Recognition numbers and location**		
	FCC/ISED	**FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte)**; FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Table of contents

Section 1. Report summary

1.1 Test specifications

FCC 47 CFR Part 27, Subpart C	Miscellaneous wireless communications services

1.2 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 662911 D01 V02r01 (Oct 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (MIMO, Smart Antenna)

1.3 Exclusions

None

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. 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 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	September 15, 2021	Original report issued

Section 2. Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

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

2.2 Technical judgment

EUT supports LTE: QPSK, 16QAM, and 64QAM modulations. The lowest (QPSK) and highest (64QAM) modulations were tested to cover the whole modulation range.

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3. Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (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.

3.2 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 4. Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

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

Table 4.1-1: *Measurement uncertainty calculations*

Test name	Measurement uncertainty, ±dB
All antenna port measurements	0.55
Occupied bandwidth	4.45
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 5. Equipment under test (EUT) details

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	Redline Communications
Applicant address	302 Town Center Blvd., Markham, ON, Canada, L3R 0E8
Manufacturer	Same as applicant

5.3 EUT information

Product	LTE Base Station – Band 41
Model	Ellipse 4G HP Band 41
Serial number	358RM2132001
Part number	RDL6000 L1
Power supply requirements	48 V_{DC} via 120 V_{AC}/ 60 Hz power supply
Product description and theory of operation	Ellipse 4G HP is an all-outdoor LTE eNodeB (E-UTRAN Node B) single band base station operating in LTE Band 41 (2496–2690 MHz)

5.4 Technical information

Frequency band	2496–2690 MHz
Frequency Min (MHz)	2498.5 (5 MHz channel); 2501.0 (10 MHz channel); 2506.0 (20 MHz channel)
Frequency Max (MHz)	2687.5 (5 MHz channel); 2685.0 (10 MHz channel); 2680.0 (20 MHz channel)
RF power Max (dBm), conducted	39.24 (5 MHz channel); 39.29 (10 MHz channel); 39.20 (20 MHz channel)
Measured BW (MHz), 99% OBW	4.50 (5 MHz channel); 9.00 (10 MHz channel); 18.02 (20 MHz channel)
Type of modulation	LTE: QPSK, 16 QAM, 64 QAM
Emission classification	5M00W7D, 10M0W7D, 20M0W7D
Power requirements	48 V_{DC} via 120–240 V_{AC} power adaptor
MIMO type	2 × 2 with completely uncorrelated type of signal
Antenna information	AFS-DBG-250090-G1 Antenna Sectoral 2.3–2.7 GHz, 16 dBi 90-deg dual-V&H RF 2xN(m) GPS TNC(m) Leads. The antenna is sufficiently uncorrelated. The EUT is professionally installed.

5.5 EUT exercise details

EUT was configured with the use of multiple TeraTerm sessions running an emulator using SSH service at IP: 192.168.25.149:2024. Set of macros provided by the manufacturer was used to exercise the EUT with individual macros for each of channel bandwidths (5, 10, 20), central frequencies (low, mid, top), and type of modulation (QPSK, 16QAM, 64QAM). Output power settings are embedded to the macros and were set to the level: 39 dBm and stayed unchanged throughout the testing. Testing was performed at both ends of the supported modulation range: at QPSK and at 64QAM).
EUT was transmitting with constant duty cycle of 67.86%. Duty cycle was calculated from the blow plot as follows: 6.8 ms / (6.8 ms + 3.22 ms) = 0.6786

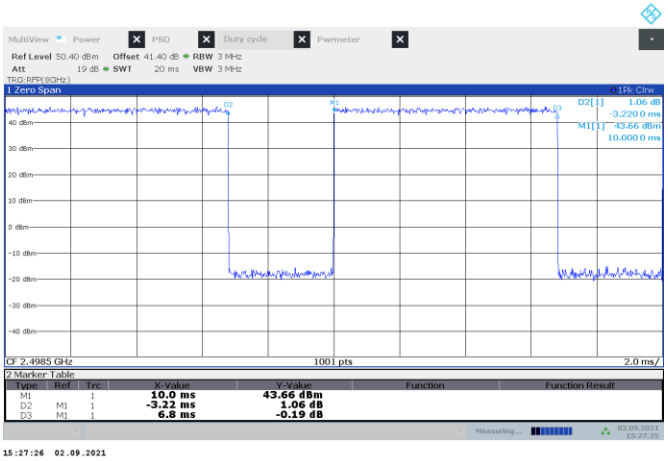


Figure 5.5-1: *Duty cycle measurement*

5.6 EUT setup diagram

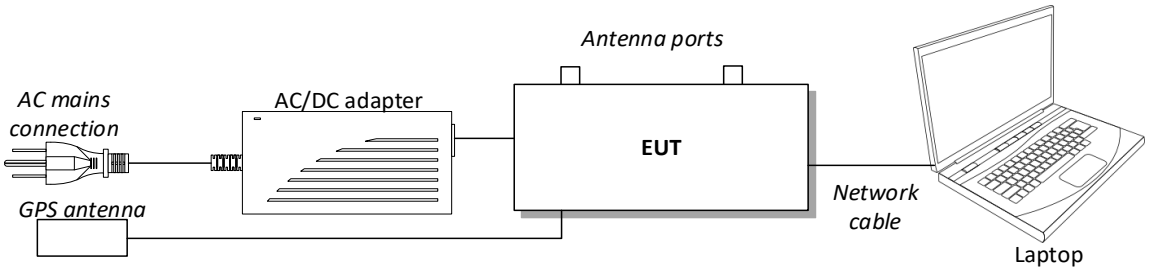


Figure 5.6-1: *Setup diagram*

5.7 EUT support equipment

Table 5.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
Power adaptor	Delta electronics	DRP048V240W1BN	D148240BNL16340198
Laptop	Dell Latitude	E6440	FA002914

Section 6. Summary of test results

6.1 Testing location

Test location (s)	Ottawa

6.2 Testing period

Test start date	September 2, 2021	Test end date	September 3, 2021

6.3 Sample information

Receipt date	September 1, 2021	Nemko sample ID number(s)	1

6.4 FCC Part 27, Subpart C and Part 2, Subpart J requirements test results

Table 6.4-1: *Test requirements results*

Part	Test description	Verdict
§27.50(h)	RF Power output	Pass
§27.53(m)	Spurious emissions	Pass
§27.54	Frequency stability	Pass
§2.1049	Occupied bandwidth	Pass

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	March 26, 2022
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
AC source	Chroma	61509	FA003036	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 6, 2021
Horn (1–18 GHz)	ETS Lindgren	3117	FA002840	1 year	February 2, 2022
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002873	1 year	October 13, 2021
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	February 2, 2022
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	May 11, 2022
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Signal and Spectrum Analyzer	Rhode&Schwarz	FSW50	FA003267	1 year	December 7, 2021
Temperature chamber	Espec	EPX-4H	FA002735	1 year	October 8, 2021
Power sensor	Rohde & Schwarz	NRP-Z91	FA002488	1 year	May 27, 2022

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

Section 8. Testing data

8.1 Number of frequencies

8.1.1 References, definitions and limits

ANSI C63.26, Clause 5.1.2:

Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in table below.

Table 8.1-1: *Frequency Range of Operation*

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

8.1.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	September 2, 2021

8.1.3 Observations, settings and special notes

None

8.1.4 Test data

Table 8.1-2: *Test channels selection*

Channel BW, MHz	Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
5	2496	2690	194	2498.5	2593.0	2687.5
10	2496	2690	194	2501.0	2593.0	2685.0
20	2496	2690	194	2506.0	2593.0	2680.0

8.2 Peak output power at RF antenna connector

8.2.1 References, definitions and limits

FCC §27.50:

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations

(1)(i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

(1)(ii) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction shall be determined by the following formula: EIRP = 33 dBW + 10 log(X/Y) dBW + 10 log(360/beamwidth) dBW, where X is the actual channel width in MHz, Y is either (i) 6 MHz if prior to transition or the station is in the MBS following transition or (ii) 5.5 MHz if the station is in the LBS and UBS following transition, and beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points.

(4) For main, booster and response stations utilizing digital emissions with non-uniform power spectral density (e.g. unfiltered QPSK), the power measured within any 100 kHz resolution bandwidth within the 6 MHz channel occupied by the non-uniform emission cannot exceed the power permitted within any 100 kHz resolution bandwidth within the 6 MHz channel if it were occupied by an emission with uniform power spectral density, i.e., if the maximum permissible power of a station utilizing a perfectly uniform power spectral density across a 6 MHz channel were 2000 watts EIRP, this would result in a maximum permissible power flux density for the station of 2000/60 = 33.3 watts EIRP per 100 kHz bandwidth. If a non-uniform emission were substituted at the station, station power would still be limited to a maximum of 33.3 watts EIRP within any 100 kHz segment of the 6 MHz channel, irrespective of the fact that this would result in a total 6 MHz channel power of less than 2000 watts EIRP.

(4)(i) Peak transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

8.2.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	September 2, 2021

8.2.3 Observations, settings and special notes

Power is measured based on ANSI C 63 26 :2015 Clause 5.2.4.2 with included duty cycle correction of 67.86%.
PSD measurement results in the tables were adjusted with duty cycle correction factor, calculated as follows: $10 \times Log_{10}(1/0.6786)$ = 1.68 dB.
Since EUT is used as a base station, EIRP limits are applicable.
Output power was
EIRP limit line calculation
For AFS-DBG-250090-G1 Antenna (Sectoral, 2.3–2.7 GHz, 16 dBi, 90-deg)
For when the station is in the MBS following transition.
$EIRP_{5\ MHz} = 63 + 10 \times Log_{10}(5 / 5.5) + 10 \times Log_{10}(360 / 90) = 68.61$ dBm
$EIRP_{10\ MHz} = 63 + 10 \times Log_{10}(10 / 5.5) + 10 \times Log_{10}(360 / 90) = 71.62$ dBm
$EIRP_{20\ MHz} = 63 + 10 \times Log_{10}(20 / 5.5) + 10 \times Log_{10}(360 / 90) = 74.63$ dBm
For when the station is in the LBS and UBS following transition.
$EIRP_{5\ MHz} = 63 + 10 \times Log_{10}(5 / 6) + 10 \times Log_{10}(360 / 90) = 68.23$ dBm
$EIRP_{10\ MHz} = 63 + 10 \times Log_{10}(10 / 6) + 10 \times Log_{10}(360 / 90) = 71.24$ dBm
$EIRP_{20\ MHz} = 63 + 10 \times Log_{10}(20 / 6) + 10 \times Log_{10}(360 / 90) = 74.25$ dBm

PSD was tested per ANSI C 63 26 :2015 Clause 5.2.4.4.2 with test receiver settings:

Detector mode	RMS
Resolution bandwidth	100 kHz
Video bandwidth	>RBW
Trace mode	Power averaging over 100 sweeps

8.2.4 Test data

Table 8.2-1: *EIRP measurements results for 5 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ant. 1/2	Output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2498.5	QPSK	1	39.03	16.00	55.03	68.23	13.20
2593.0	QPSK	1	38.89	16.00	54.89	68.61	13.72
2687.5	QPSK	1	39.04	16.00	55.04	68.23	13.19
2498.5	QPSK	2	38.53	16.00	54.53	68.23	13.70
2593.0	QPSK	2	38.41	16.00	54.41	68.61	14.20
2687.5	QPSK	2	38.35	16.00	54.35	68.23	13.88
2498.5	64-QAM	1	**39.24**	16.00	55.24	68.23	12.99
2593.0	64-QAM	1	39.22	16.00	55.22	68.61	13.39
2687.5	64-QAM	1	38.94	16.00	54.94	68.23	13.29
2498.5	64-QAM	2	38.70	16.00	54.70	68.23	13.53
2593.0	64-QAM	2	38.73	16.00	54.73	68.61	13.88
2687.5	64-QAM	2	38.21	16.00	54.21	68.23	14.02

Table 8.2-2: *EIRP measurements results for 5 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	Output power ch1, dBm	Output power ch2, dBm	Total output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2498.5	QPSK	39.03	38.53	41.80	16.00	57.80	68.23	10.43
2593.0	QPSK	38.89	38.41	41.67	16.00	57.67	68.61	10.94
2687.5	QPSK	39.04	38.35	41.72	16.00	57.72	68.23	10.51
2498.5	64-QAM	39.24	38.70	41.99	16.00	57.99	68.23	10.24
2593.0	64-QAM	39.22	38.73	41.99	16.00	57.99	68.61	10.62
2687.5	64-QAM	38.94	38.21	41.60	16.00	57.60	68.23	10.63

Table 8.2-3: *EIRP measurements results for 10 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ant. 1/2	Output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2501.0	QPSK	1	39.17	16.00	55.17	71.24	16.07
2593.0	QPSK	1	39.26	16.00	55.26	71.62	16.36
2685.0	QPSK	1	**39.29**	16.00	55.29	71.24	15.95
2501.0	QPSK	2	38.67	16.00	54.67	71.24	16.57
2593.0	QPSK	2	38.57	16.00	54.57	71.62	17.05
2685.0	QPSK	2	38.64	16.00	54.64	71.24	16.60
2501.0	64-QAM	1	39.11	16.00	55.11	71.24	16.13
2593.0	64-QAM	1	39.01	16.00	55.01	71.62	16.61
2685.0	64-QAM	1	39.06	16.00	55.06	71.24	16.18
2501.0	64-QAM	2	38.63	16.00	54.63	71.24	16.61
2593.0	64-QAM	2	38.39	16.00	54.39	71.62	17.23
2685.0	64-QAM	2	38.25	16.00	54.25	71.24	16.99

Table 8.2-4: *EIRP measurements results for 10 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	Output power ch1, dBm	Output power ch2, dBm	Total output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2501.0	QPSK	39.17	38.67	41.94	16.00	57.94	71.24	13.30
2593.0	QPSK	39.26	38.57	41.94	16.00	57.94	71.62	13.68
2685.0	QPSK	39.29	38.64	41.99	16.00	57.99	71.24	13.25
2501.0	64-QAM	39.11	38.63	41.89	16.00	57.89	71.24	13.35
2593.0	64-QAM	39.01	38.39	41.72	16.00	57.72	71.62	13.90
2685.0	64-QAM	39.06	38.25	41.68	16.00	57.68	71.24	13.56

Test data, continued

Table 8.2-5: *EIRP measurements results for 20 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ant. 1/2	Output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2506.0	QPSK	1	38.96	16.00	54.96	74.25	19.29
2593.0	QPSK	1	39.08	16.00	55.08	74.63	19.55
2680.0	QPSK	1	39.03	16.00	55.03	74.25	19.22
2506.0	QPSK	2	38.41	16.00	54.41	74.25	19.84
2593.0	QPSK	2	38.39	16.00	54.39	74.63	20.24
2680.0	QPSK	2	38.29	16.00	54.29	74.25	19.96
2506.0	64-QAM	1	39.01	16.00	55.01	74.25	19.24
2593.0	64-QAM	1	39.10	16.00	55.10	74.63	19.53
2680.0	64-QAM	1	**39.20**	16.00	55.20	74.25	19.05
2506.0	64-QAM	2	38.43	16.00	54.43	74.25	19.82
2593.0	64-QAM	2	38.49	16.00	54.49	74.63	20.14
2680.0	64-QAM	2	38.51	16.00	54.51	74.25	19.74

Table 8.2-6: *EIRP measurements results for 20 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	Output power ch1, dBm	Output power ch2, dBm	Total output power, dBm	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
2506.0	QPSK	38.96	38.41	41.70	16.00	57.70	71.24	13.54
2593.0	QPSK	39.08	38.39	41.76	16.00	57.76	71.62	13.86
2680.0	QPSK	39.03	38.29	41.69	16.00	57.69	71.24	13.55
2506.0	64-QAM	39.01	38.43	41.74	16.00	57.74	71.24	13.50
2593.0	64-QAM	39.10	38.49	41.82	16.00	57.82	71.62	13.80
2680.0	64-QAM	39.20	38.51	41.88	16.00	57.88	71.24	13.36

Table 8.2-7: *PSD EIRP measurements results for 5 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ch 1/2	PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2498.5	QPSK	1	23.94	16.00	39.94	45.23	5.29
2593.0	QPSK	1	25.41	16.00	41.41	45.23	3.82
2687.5	QPSK	1	24.41	16.00	40.41	45.23	4.82
2498.5	QPSK	2	24.29	16.00	40.29	45.23	4.94
2593.0	QPSK	2	25.12	16.00	41.12	45.23	4.11
2687.5	QPSK	2	22.89	16.00	38.89	45.23	6.34
2498.5	64-QAM	1	24.28	16.00	40.28	45.23	4.95
2593.0	64-QAM	1	24.08	16.00	40.08	45.23	5.15
2687.5	64-QAM	1	24.46	16.00	40.46	45.23	4.77
2498.5	64-QAM	2	24.34	16.00	40.34	45.23	4.89
2593.0	64-QAM	2	24.60	16.00	40.60	45.23	4.63
2687.5	64-QAM	2	24.10	16.00	40.10	45.23	5.13

Table 8.2-8: *PSD EIRP measurements results for 5 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	PSD on ch1, dBm/100 kHz	PSD on ch2, dBm/100 kHz	Total PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2498.5	QPSK	23.94	24.29	27.13	16.00	43.13	45.23	2.10
2593.0	QPSK	25.41	25.12	28.28	16.00	44.28	45.23	0.95
2687.5	QPSK	24.41	22.89	26.73	16.00	42.73	45.23	2.50
2498.5	64-QAM	24.28	24.34	27.32	16.00	43.32	45.23	1.91
2593.0	64-QAM	24.08	24.60	27.36	16.00	43.36	45.23	1.87
2687.5	64-QAM	24.46	24.10	27.29	16.00	43.29	45.23	1.94

Test data, continued

Table 8.2-9: *PSD EIRP measurements results for 10 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ch 1/2	PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2501.0	QPSK	1	21.14	16.00	37.14	45.23	8.09
2593.0	QPSK	1	21.59	16.00	37.59	45.23	7.64
2685.0	QPSK	1	21.27	16.00	37.27	45.23	7.96
2501.0	QPSK	2	21.13	16.00	37.13	45.23	8.10
2593.0	QPSK	2	21.24	16.00	37.24	45.23	7.99
2685.0	QPSK	2	22.26	16.00	38.26	45.23	6.97
2501.0	64-QAM	1	21.31	16.00	37.31	45.23	7.92
2593.0	64-QAM	1	21.15	16.00	37.15	45.23	8.08
2685.0	64-QAM	1	21.12	16.00	37.12	45.23	8.11
2501.0	64-QAM	2	21.43	16.00	37.43	45.23	7.80
2593.0	64-QAM	2	21.39	16.00	37.39	45.23	7.84
2685.0	64-QAM	2	21.21	16.00	37.21	45.23	8.02

Table 8.2-10: *PSD EIRP measurements results for 10 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	PSD on ch1, dBm/100 kHz	PSD on ch2, dBm/100 kHz	Total PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2501.0	QPSK	21.14	21.13	24.15	16.00	40.15	45.23	5.08
2593.0	QPSK	21.59	21.24	24.43	16.00	40.43	45.23	4.80
2685.0	QPSK	21.27	22.26	24.80	16.00	40.80	45.23	4.43
2501.0	64-QAM	21.31	21.43	24.38	16.00	40.38	45.23	4.85
2593.0	64-QAM	21.15	21.39	24.28	16.00	40.28	45.23	4.95
2685.0	64-QAM	21.12	21.21	24.18	16.00	40.18	45.23	5.05

Table 8.2-11: *PSD EIRP measurements results for 20 MHz channel bandwidth for SISO operation*

Frequency, MHz	Modulation	Ch 1/2	PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2506.0	QPSK	1	18.07	16.00	34.07	45.23	11.16
2593.0	QPSK	1	18.59	16.00	34.59	45.23	10.64
2680.0	QPSK	1	18.44	16.00	34.44	45.23	10.79
2506.0	QPSK	2	18.31	16.00	34.31	45.23	10.92
2593.0	QPSK	2	18.69	16.00	34.69	45.23	10.54
2680.0	QPSK	2	18.46	16.00	34.46	45.23	10.77
2506.0	64-QAM	1	18.10	16.00	34.10	45.23	11.13
2593.0	64-QAM	1	18.05	16.00	34.05	45.23	11.18
2680.0	64-QAM	1	18.13	16.00	34.13	45.23	11.10
2506.0	64-QAM	2	18.46	16.00	34.46	45.23	10.77
2593.0	64-QAM	2	18.73	16.00	34.73	45.23	10.50
2680.0	64-QAM	2	18.33	16.00	34.33	45.23	10.90

Table 8.2-12: *PSD EIRP measurements results for 20 MHz channel bandwidth for MIMO operation*

Frequency, MHz	Modulation	PSD on ch1, dBm/100 kHz	PSD on ch2, dBm/100 kHz	Total PSD, dBm/100 kHz	Antenna gain, dBi	EIRP PSD, dBm/100 kHz	Limit, dBm/100 kHz	Margin, dB
2506.0	QPSK	18.07	18.31	21.20	16.00	37.20	45.23	8.03
2593.0	QPSK	18.59	18.69	21.65	16.00	37.65	45.23	7.58
2680.0	QPSK	18.44	18.46	21.46	16.00	37.46	45.23	7.77
2506.0	64-QAM	18.10	18.46	21.29	16.00	37.29	45.23	7.94
2593.0	64-QAM	18.05	18.73	21.41	16.00	37.41	45.23	7.82
2680.0	64-QAM	18.13	18.33	21.24	16.00	37.24	45.23	7.99

Test data, continued

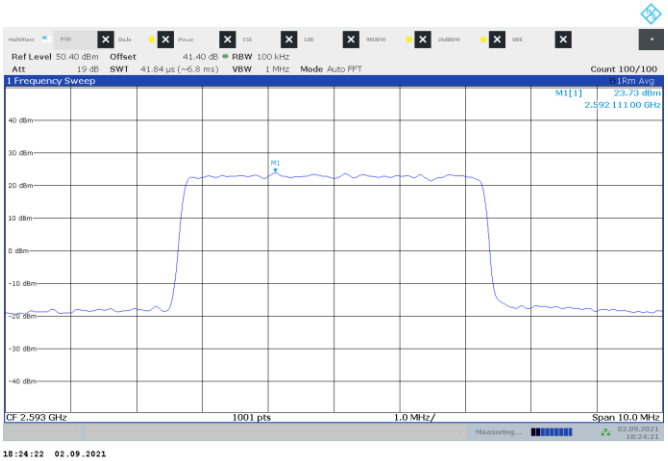


Figure 8.2-1: *PSD for 5 MHz channel BW, sample plot*

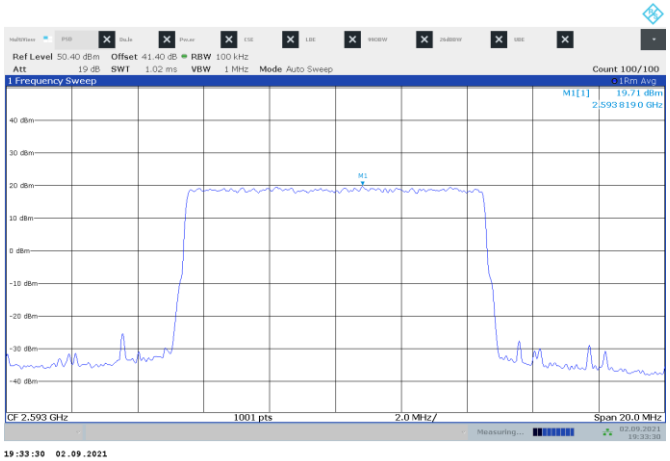


Figure 8.2-2: *PSD for 10 MHz channel BW, sample plot*

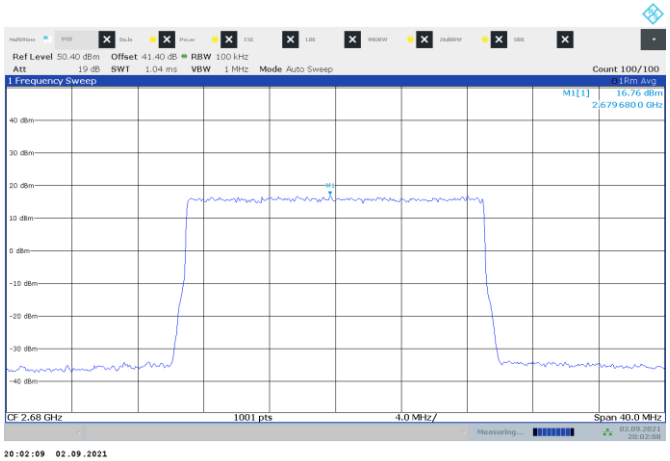


Figure 8.2-3: *PSD for 20 MHz channel BW, sample plot*

8.3 Spurious emissions

8.3.1 References, definitions and limits

FCC §27.53:

(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(1) Prior to the transition, and thereafter, solely within the MBS, for analog operations with an EIRP in excess of −9 dBW, the signal shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. Provided that a documented interference complaint cannot be mutually resolved between the parties prior to the applicable deadline, then the following additional attenuation requirements shall apply:

(2)(i) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located 1.5 km or more away, within 24 hours of the receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block and shall immediately notify the complaining licensee upon implementation of the additional attenuation. No later than 60 days after the implementation of such additional attenuation, the licensee of the complaining base station must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(2)(ii) If a pre-existing base station suffers harmful interference from emissions caused by a new or modified base station located less than 1.5 km away, within 24 hours of receipt of a documented interference complaint the licensee of the new or modified base station must attenuate its emissions by at least 67 + 10 log (P)−20 log (Dkm/1.5) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the complaining licensee, or if both base stations are co-located, limit its undesired signal level at the pre-existing base station receiver(s) to no more than −107 dBm measured in a 5.5 megahertz bandwidth and shall immediately notify the complaining licensee upon such reduction in the undesired signal level. No later than 60 days after such reduction in the undesired signal level, the complaining licensee must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(2)(iii) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located 1.5 km or more away, within 60 days of receipt of a documented interference complaint the licensee of each base station must attenuate its base station emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the other licensee.

(2)(iv) If a new or modified base station suffers harmful interference from emissions caused by a pre-existing base station located less than 1.5 km away, within 60 days of receipt of a documented interference complaint: (a) The licensee of the new or modified base station must attenuate its OOBE by at least 67 + 10 log (P)−20 log (Dkm/1.5) measured 3 megahertz above or below, from the channel edge of its frequency block of the other licensee, or if the base stations are co-located, limit its undesired signal level at the other base station receiver(s) to no more than −107 dBm measured in a 5.5-megahertz bandwidth; and (b) the licensee causing the interference must attenuate its emissions by at least 67 + 10 log (P) dB measured at 3 megahertz, above or below, from the channel edge of its frequency block of the new or modified base station.

(2)(v) For all fixed digital user stations, the attenuation factor shall be not less than 43 + 10 log (P) dB at the channel edge.

(3) Prior to transition and thereafter solely within the MBS, and notwithstanding paragraph (l)(2) of this section, the maximum out-of-band power of a digital transmitter operating on a single 6 MHz channel with an EIRP in excess of −9 dBW (21 dBm) employing digital modulation for the primary purpose of transmitting video programming shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies.

(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

8.3.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	September 2, 2021

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
The output terminals of EUT were connected to RF dummy 50-Ω load for radiated measurement.
The measurements were performed at the distance of 3 m up to 18 GHz and 30 cm above 18 GHz.
Spurious emission measurements based on ANSI C 63.26:2015 Clause 5.7.4 Spurious unwanted emission measurements.
Band edge emissions measurements are based on ANSI C 63.26:2015 Clause 5.7.3 Out of band unwanted emissions measurements.

Spectrum analyzer settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz (below 1 GHz) and 1 MHz (above 1 GHz)
Video bandwidth:	≥ RBW
Detector mode:	RMS
Trace mode:	Averaging

Spectrum analyser settings for band edge emissions:

Resolution bandwidth	100 kHz for 5 MHz BW, 200 kHz for 10 MHz BW, 300 kHz for 20 MHz BW
Video bandwidth	≥ RBW
Detector mode	RMS
Trace mode	Power Average over 1 MHz bandwidth

8.3.4 Test data

Table 8.3-1: *Band edge emission measurements results at 2496 and 2690 MHz for 5 MHz channel for SISO operation*

Antenna port	Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
1	QPSK	2498.5	2496.0	-19.69	-13.00	6.69
2	QPSK	2498.5	2496.0	-17.25	-13.00	4.25
1	64QAM	2687.5	2690.0	-19.61	-13.00	6.61
2	64QAM	2687.5	2690.0	-14.50	-13.00	1.50
1	QPSK	2498.5	2496.0	-16.88	-13.00	3.88
2	QPSK	2498.5	2496.0	-18.04	-13.00	5.04
1	64QAM	2687.5	2690.0	-19.80	-13.00	6.80
2	64QAM	2687.5	2690.0	-18.69	-13.00	5.69

Table 8.3-2: *Band edge emission measurements results at 2496 and 2690 MHz for 5 MHz channel for MIMO operation*

Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level at ch1, dBm/MHz	Emission level at ch2, dBm/MHz	Total Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	2498.5	2496.0	-19.69	-17.25	-15.29	-13.00	2.29
64QAM	2687.5	2690.0	-19.61	-14.50	-13.33	-13.00	0.33
QPSK	2498.5	2496.0	-16.88	-18.04	-14.41	-13.00	1.41
64QAM	2687.5	2690.0	-19.80	-18.69	-16.20	-13.00	3.20

Test data, continued

Table 8.3-3: *Band edge emission measurements results at 2496 and 2690 MHz for 10 MHz channel for SISO operation*

Antenna port	Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
1	QPSK	2501.0	2496.0	-22.22	-13.00	9.22
2	QPSK	2501.0	2496.0	-21.16	-13.00	8.16
1	64QAM	2685.0	2690.0	-20.29	-13.00	7.29
2	64QAM	2685.0	2690.0	-20.04	-13.00	7.04
1	QPSK	2501.0	2496.0	-21.61	-13.00	8.61
2	QPSK	2501.0	2496.0	-21.42	-13.00	8.42
1	64QAM	2685.0	2690.0	-22.65	-13.00	9.65
2	64QAM	2685.0	2690.0	-20.45	-13.00	7.45

Table 8.3-4: *Band edge emission measurements results at 2496 and 2690 MHz for 10 MHz channel for MIMO operation*

Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level at ch1, dBm/MHz	Emission level at ch2, dBm/MHz	Total Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	2501.0	2496.0	-22.22	-21.16	-18.65	-13.00	5.65
64QAM	2685.0	2690.0	-20.29	-20.04	-17.15	-13.00	4.15
QPSK	2501.0	2496.0	-21.61	-21.42	-18.50	-13.00	5.50
64QAM	2685.0	2690.0	-22.65	-20.45	-18.40	-13.00	5.40

Table 8.3-5: *Band edge emission measurements results at 2496 and 2690 MHz for 20 MHz channel for SISO operation*

Antenna port	Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
1	QPSK	2506.0	2496.0	-24.40	-13.00	11.40
2	QPSK	2506.0	2496.0	-24.01	-13.00	11.01
1	64QAM	2680.0	2690.0	-21.96	-13.00	8.96
2	64QAM	2680.0	2690.0	-22.83	-13.00	9.83
1	QPSK	2506.0	2496.0	-27.21	-13.00	14.21
2	QPSK	2506.0	2496.0	-24.99	-13.00	11.99
1	64QAM	2680.0	2690.0	-26.47	-13.00	13.47
2	64QAM	2680.0	2690.0	-23.83	-13.00	10.83

Table 8.3-6: *Band edge emission measurements results at 2496 and 2690 MHz for 20 MHz channel for MIMO operation*

Modulation	Fundamental frequency, MHz	Frequency of max emission, MHz	Emission level at ch1, dBm/MHz	Emission level at ch2, dBm/MHz	Total Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	2506.0	2496.0	-24.40	-24.01	-21.19	-13.00	8.19
64QAM	2680.0	2690.0	-21.96	-22.83	-19.36	-13.00	6.36
QPSK	2506.0	2496.0	-27.21	-24.99	-22.95	-13.00	9.95
64QAM	2680.0	2690.0	-26.47	-23.83	-21.94	-13.00	8.94

Test data, continued

Figure 8.3-1: *Band edge measurement for Ant 1 QPSK 5 MHz low channel*

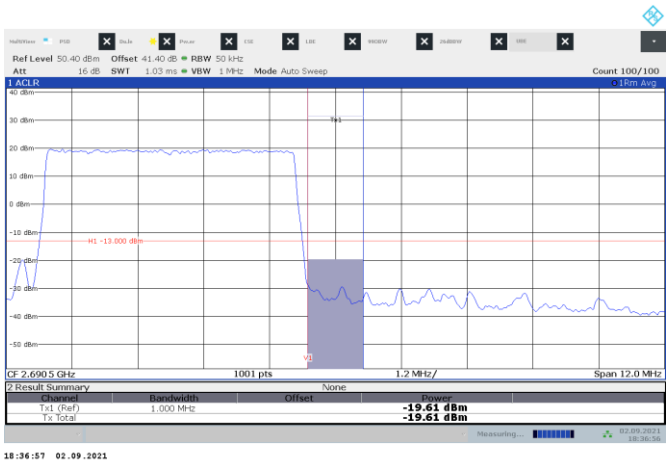


Figure 8.3-2: *Band edge measurement for Ant 1 QPSK 5 MHz top channel*

Figure 8.3-3: *Band edge measurement for Ant 2 QPSK 5 MHz low channel*

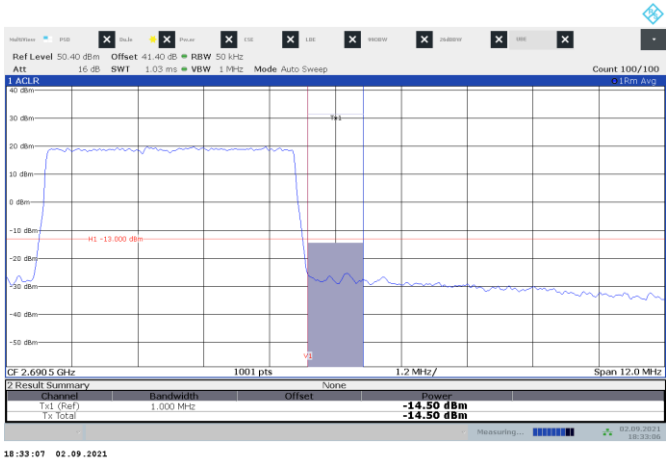


Figure 8.3-4: *Band edge measurement for Ant 2 QPSK 5 MHz top channel*

Test data, continued

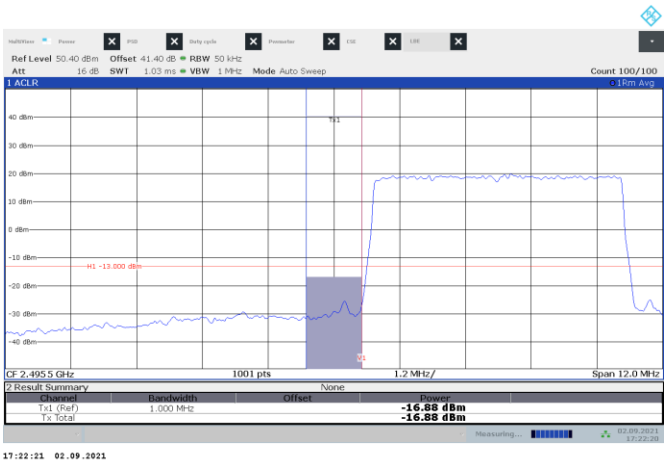


Figure 8.3-5: *Band edge measurement for Ant 1 64QAM 5 MHz low channel*

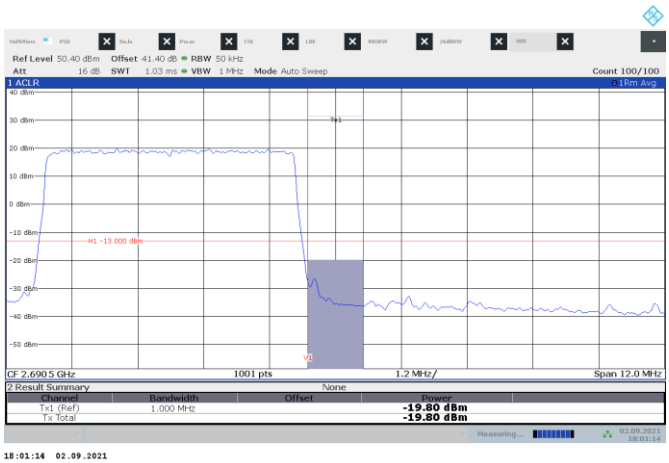


Figure 8.3-6: *Band edge measurement for Ant 1 64QAM 5 MHz top channel*

Figure 8.3-7: *Band edge measurement for Ant 2 64QAM 5 MHz low channel*

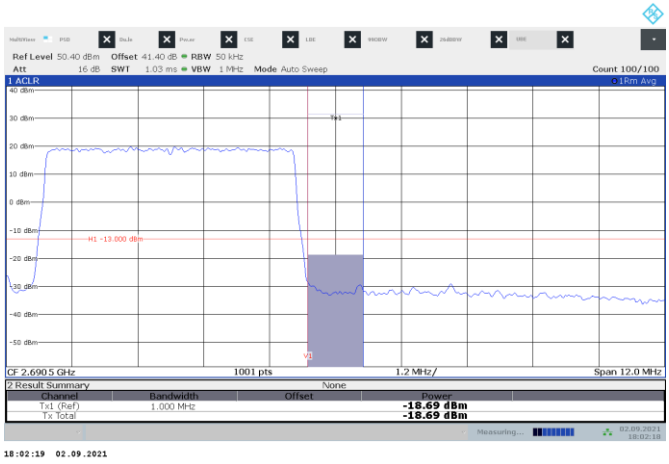


Figure 8.3-8: *Band edge measurement for Ant 2 64QAM 5 MHz top channel*

Test data, continued

Figure 8.3-9: *Band edge measurement for Ant 1 QPSK 10 MHz low channel*

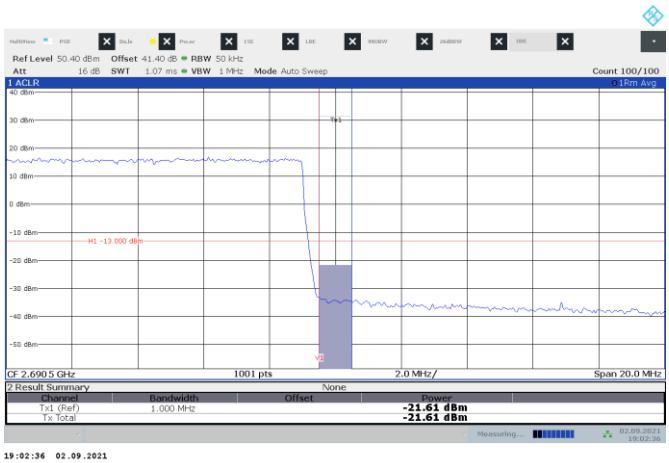


Figure 8.3-10: *Band edge measurement for Ant 1 QPSK 10 MHz top channel*

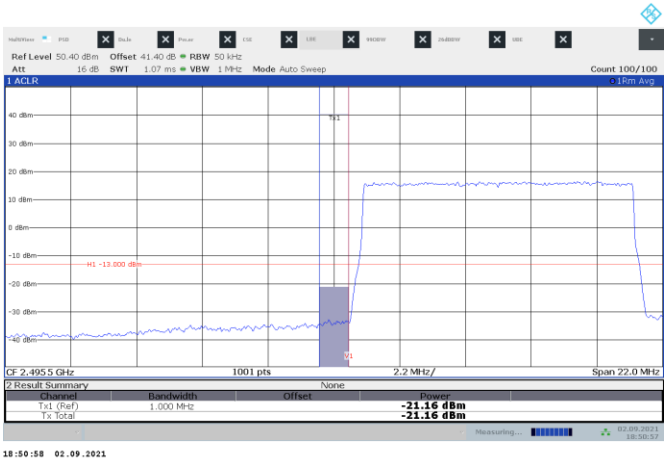


Figure 8.3-11: *Band edge measurement for Ant 2 QPSK 10 MHz low channel*

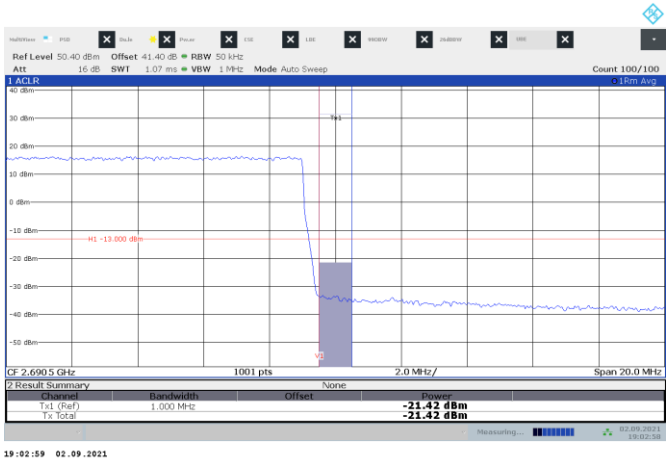


Figure 8.3-12: *Band edge measurement for Ant 2 QPSK 10 MHz top channel*

Test data, continued

Figure 8.3-13: *Band edge measurement for Ant 1 64QAM 10 MHz low channel*

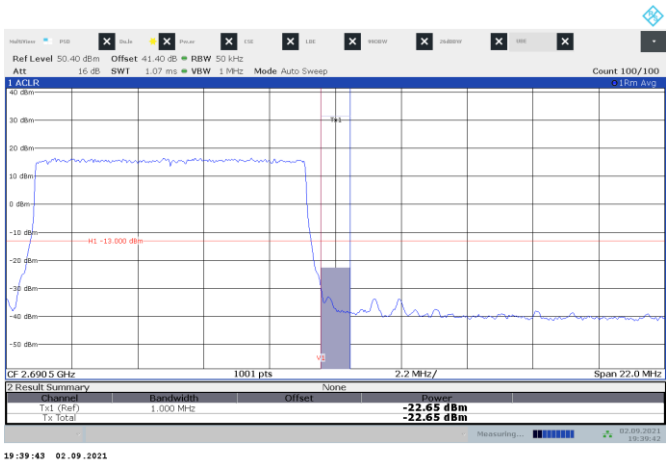


Figure 8.3-14: *Band edge measurement for Ant 1 64QAM 10 MHz top channel*

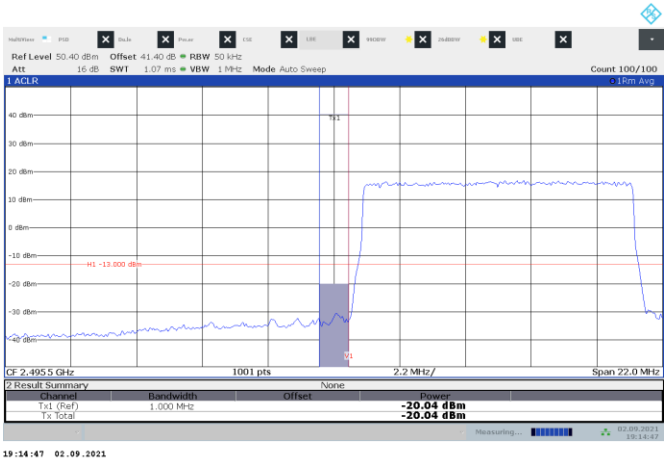


Figure 8.3-15: *Band edge measurement for Ant 2 64QAM 10 MHz low channel*

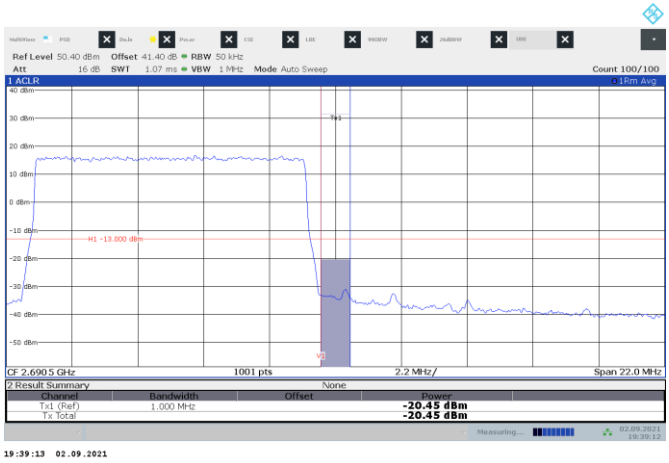


Figure 8.3-16: *Band edge measurement for Ant 2 64QAM 10 MHz top channel*

Test data, continued

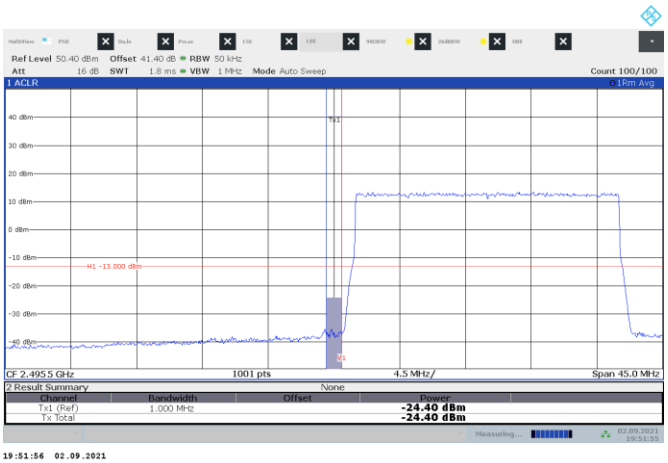


Figure 8.3-17: *Band edge measurement for Ant 1 QPSK 20 MHz low channel*

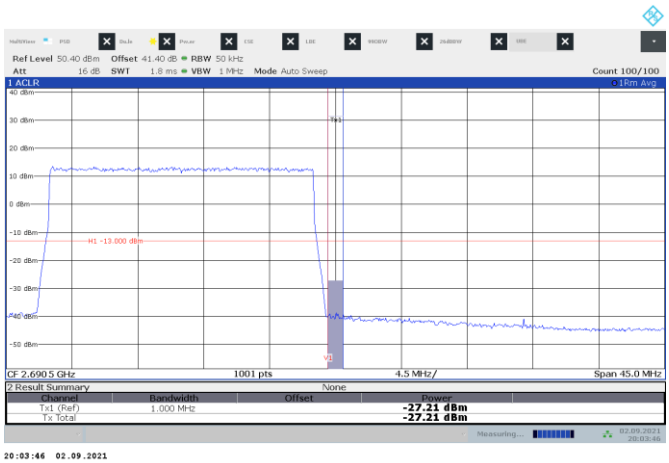


Figure 8.3-18: *Band edge measurement for Ant 1 QPSK 20 MHz top channel*

Figure 8.3-19: *Band edge measurement for Ant 2 QPSK 20 MHz low channel*

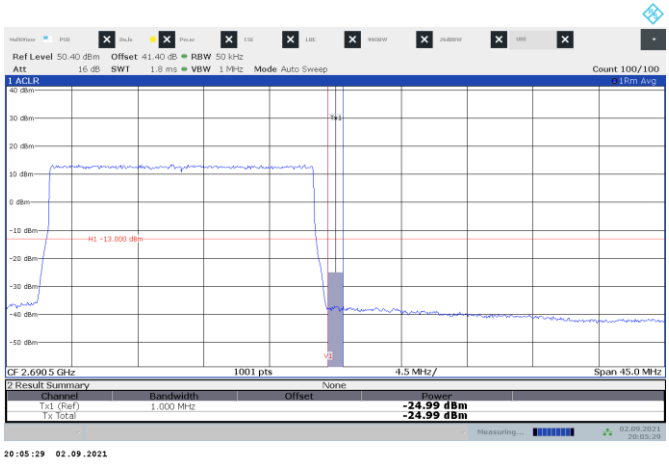


Figure 8.3-20: *Band edge measurement for Ant 2 QPSK 20 MHz top channel*

Test data, continued

Figure 8.3-21: *Band edge measurement for Ant 1 64QAM 20 MHz low channel*

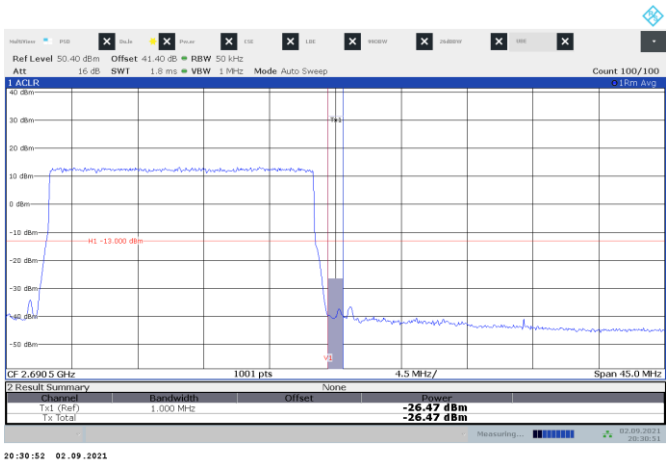


Figure 8.3-22: *Band edge measurement for Ant 1 64QAM 20 MHz top channel*

Figure 8.3-23: *Band edge measurement for Ant 2 64QAM 20 MHz low channel*

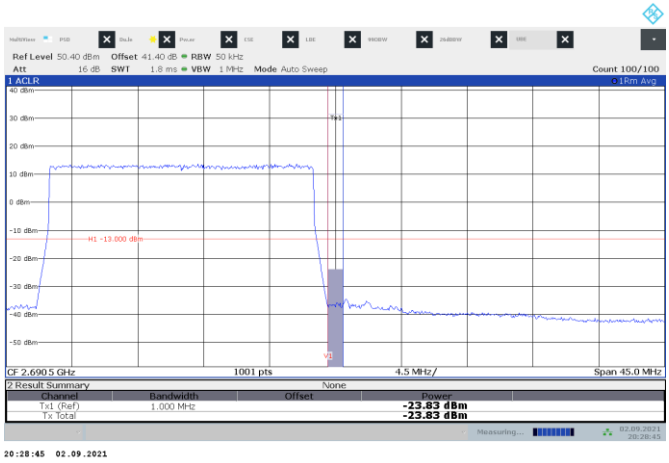


Figure 8.3-24: *Band edge measurement for Ant 2 64QAM 20 MHz top channel*

Test data, continued

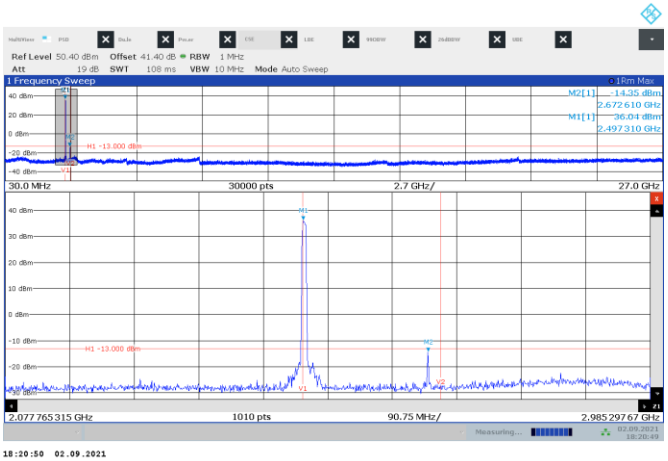


Figure 8.3-25 *Conducted spurious emissions at Ant 1 QPSK 5 MHz low channel*

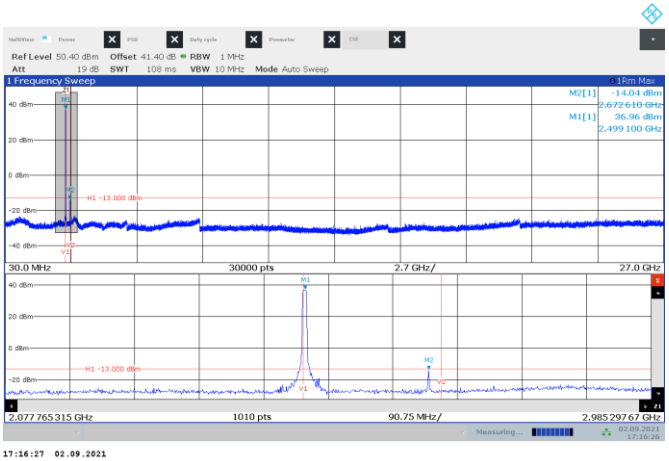


Figure 8.3-26: *Conducted spurious emissions at Ant 1 64QAM 5 MHz low channel*

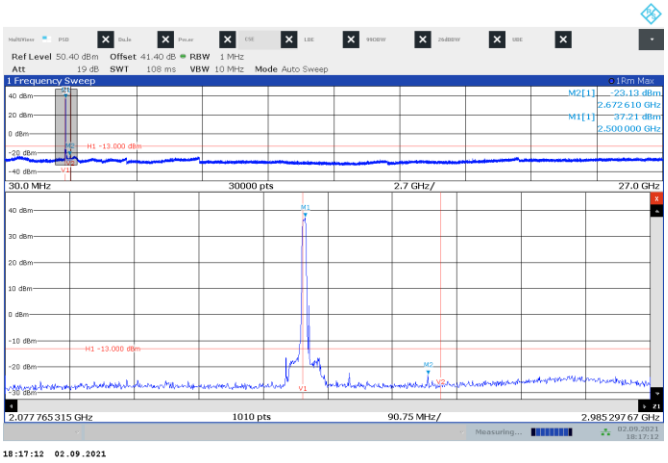


Figure 8.3-27 *Conducted spurious emissions at Ant 2 QPSK 5 MHz low channel*

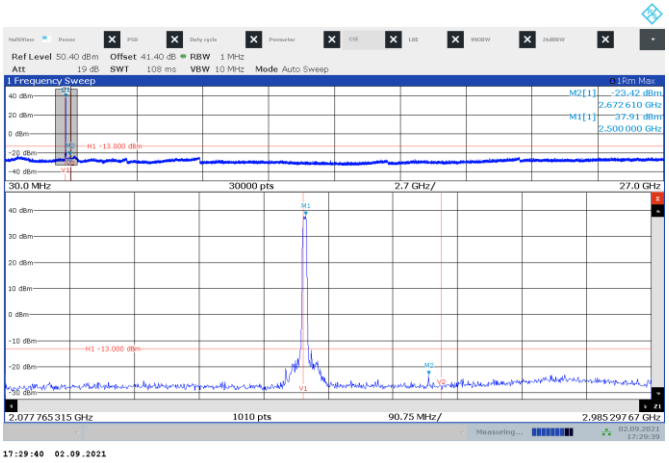


Figure 8.3-28: *Conducted spurious emissions at Ant 2 64QAM 5 MHz low channel*

Test data, continued

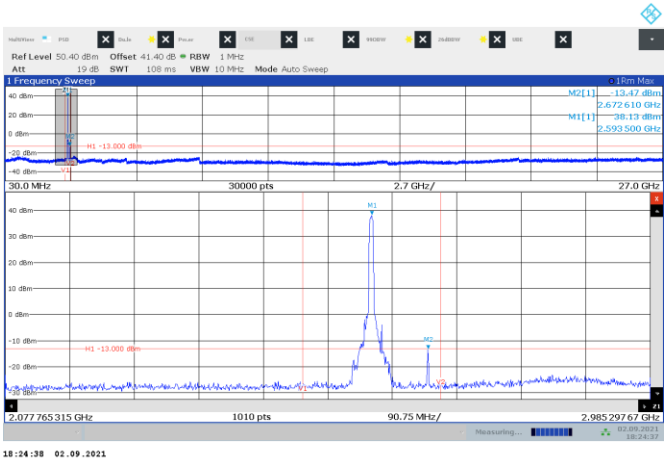


Figure 8.3-29 *Conducted spurious emissions at Ant 1 QPSK 5 MHz mid channel*

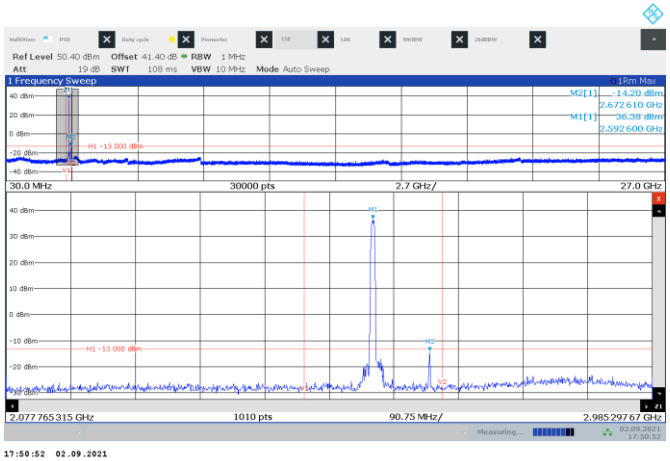


Figure 8.3-30: *Conducted spurious emissions at Ant 1 64QAM 5 MHz mid channel*

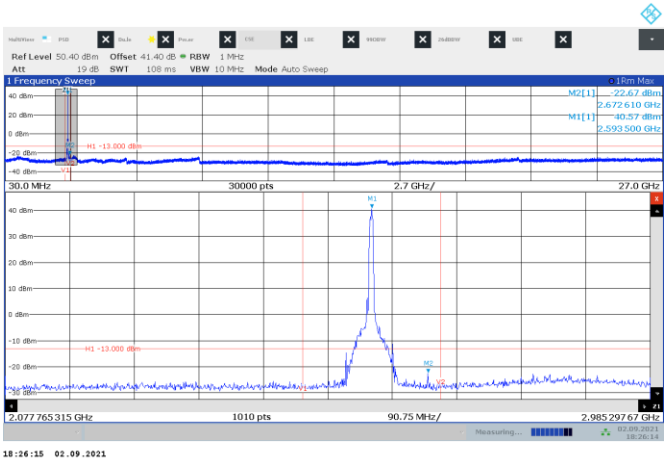


Figure 8.3-31 *Conducted spurious emissions at Ant 2 QPSK 5 MHz mid channel*

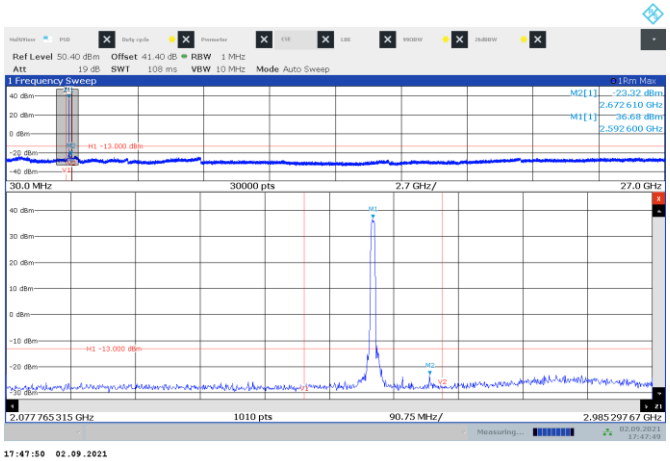


Figure 8.3-32: *Conducted spurious emissions at Ant 2 64QAM 5 MHz mid channel*

Test data, continued

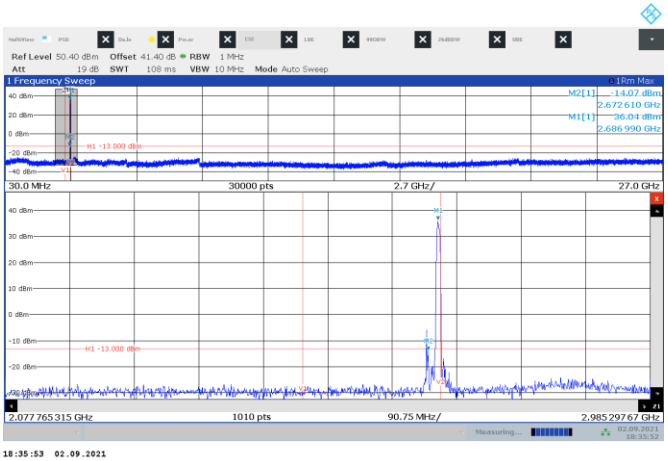


Figure 8.3-33 *Conducted spurious emissions at Ant 1 QPSK 5 MHz top channel*

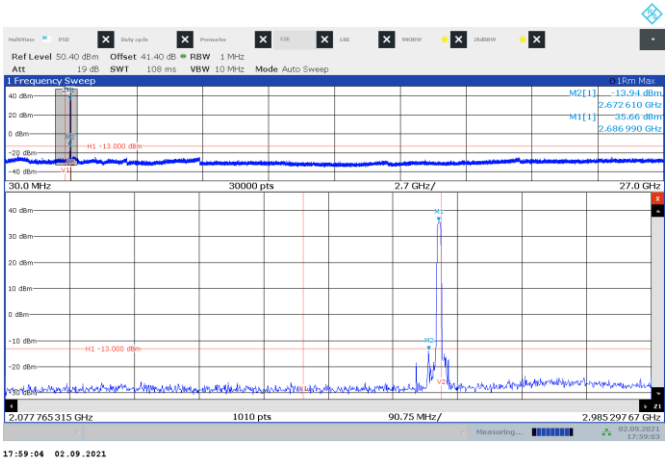


Figure 8.3-34: *Conducted spurious emissions at Ant 1 64QAM 5 MHz top channel*

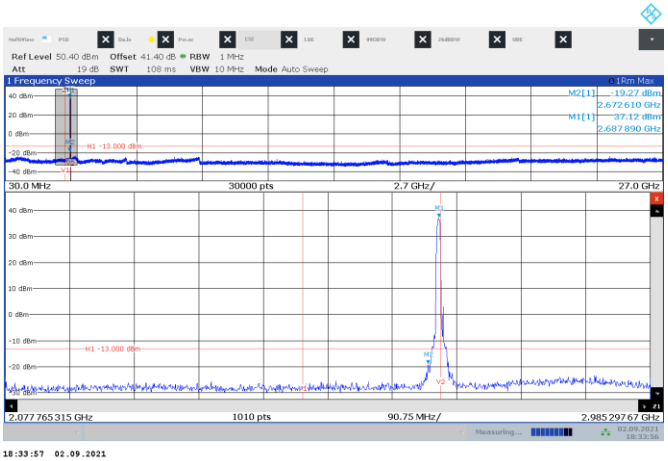


Figure 8.3-35 *Conducted spurious emissions at Ant 2 QPSK 5 MHz top channel*

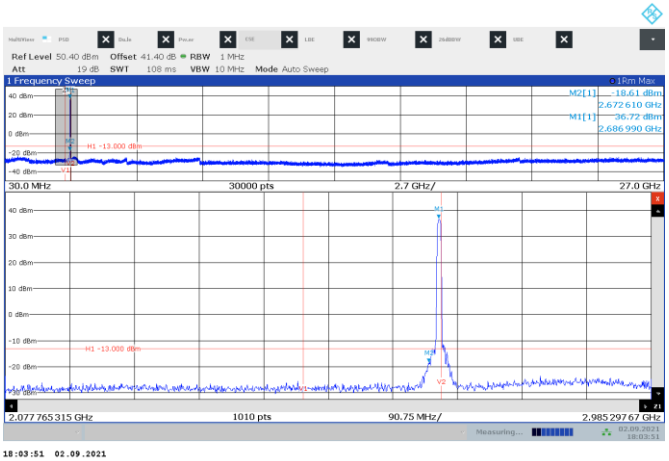


Figure 8.3-36: *Conducted spurious emissions at Ant 2 64QAM 5 MHz top channel*

Test data, continued

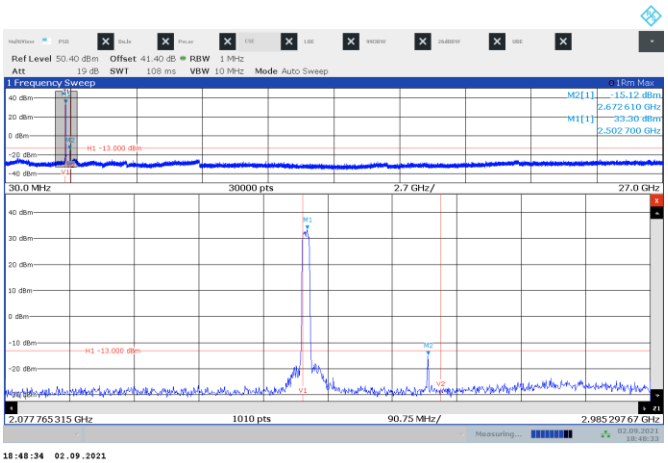


Figure 8.3-37 *Conducted spurious emissions at Ant 1 QPSK 10 MHz low channel*

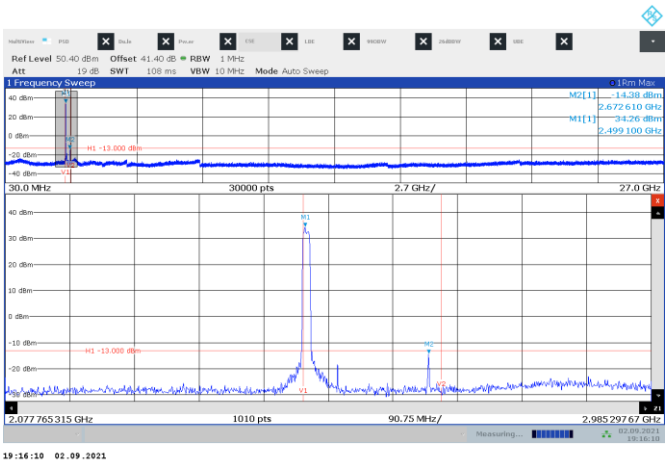


Figure 8.3-38: *Conducted spurious emissions at Ant 1 64QAM 10 MHz low channel*

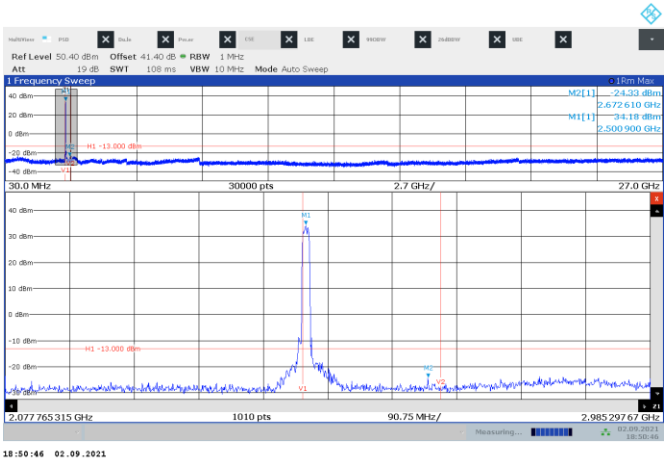


Figure 8.3-39 *Conducted spurious emissions at Ant 2 QPSK 10 MHz low channel*

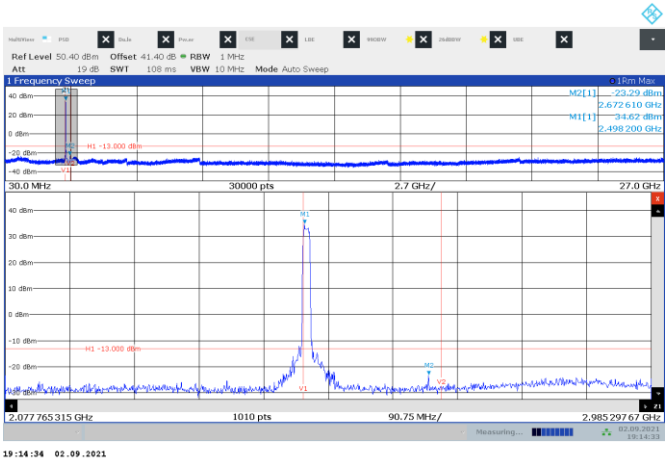


Figure 8.3-40: *Conducted spurious emissions at Ant 2 64QAM 10 MHz low channel*

Test data, continued

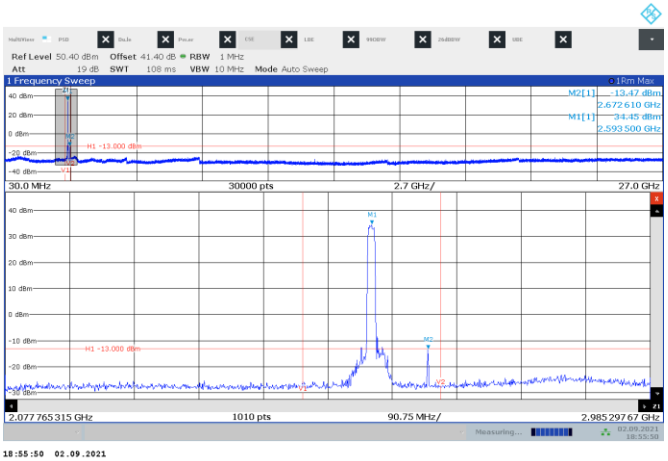


Figure 8.3-41 *Conducted spurious emissions at Ant 1 QPSK 10 MHz mid channel*

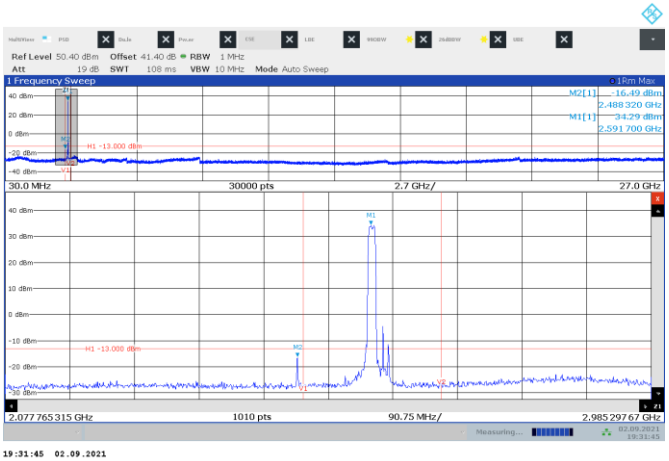


Figure 8.3-42: *Conducted spurious emissions at Ant 1 64QAM 10 MHz mid channel*

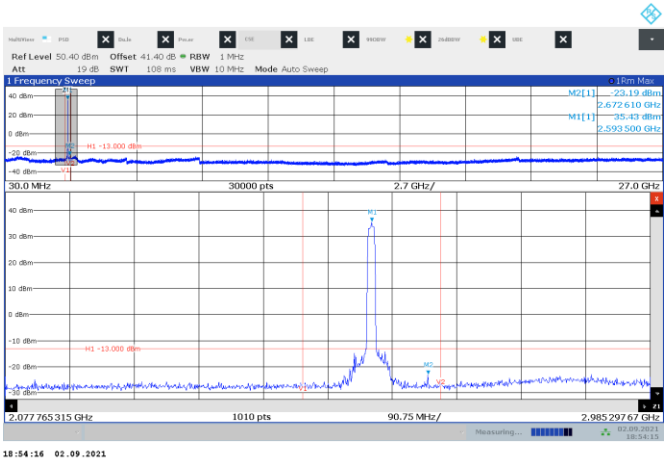


Figure 8.3-43 *Conducted spurious emissions at Ant 2 QPSK 10 MHz mid channel*

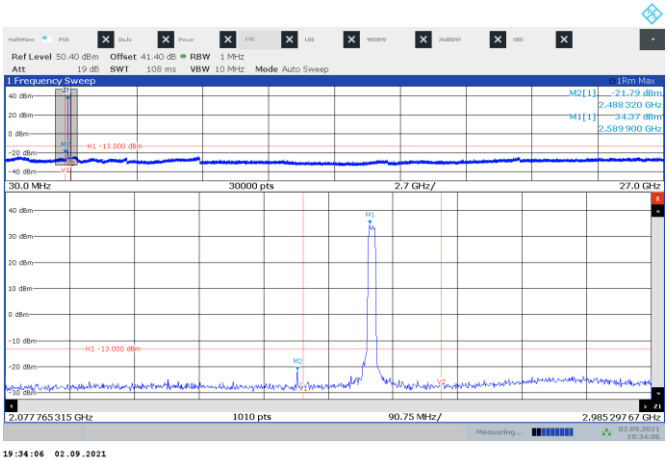


Figure 8.3-44: *Conducted spurious emissions at Ant 2 64QAM 10 MHz mid channel*

Test data, continued

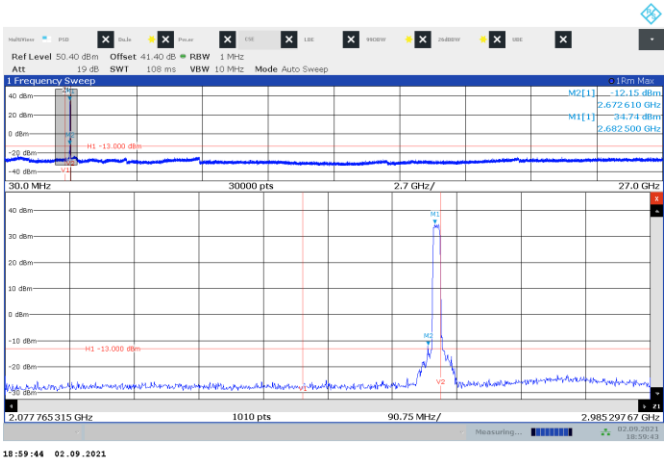


Figure 8.3-45 *Conducted spurious emissions at Ant 1 QPSK 10 MHz top channel*

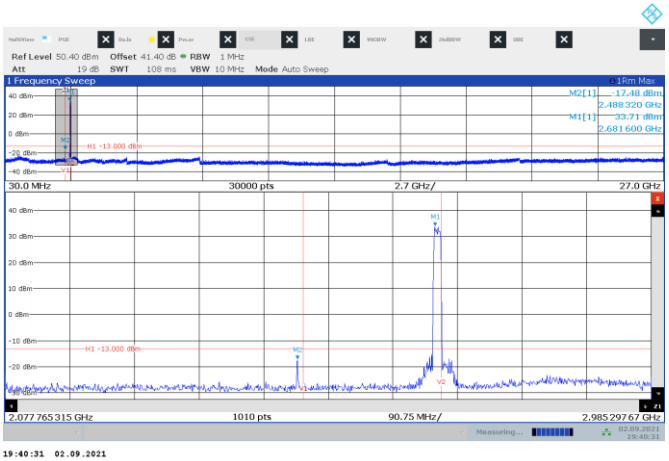


Figure 8.3-46: *Conducted spurious emissions at Ant 1 64QAM 10 MHz top channel*

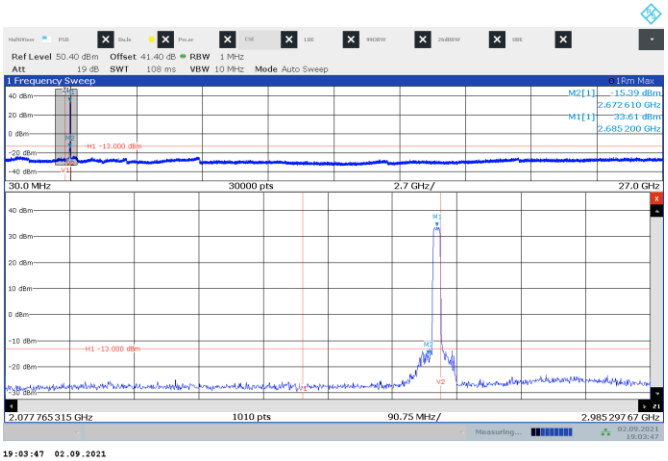


Figure 8.3-47 *Conducted spurious emissions at Ant 2 QPSK 10 MHz top channel*

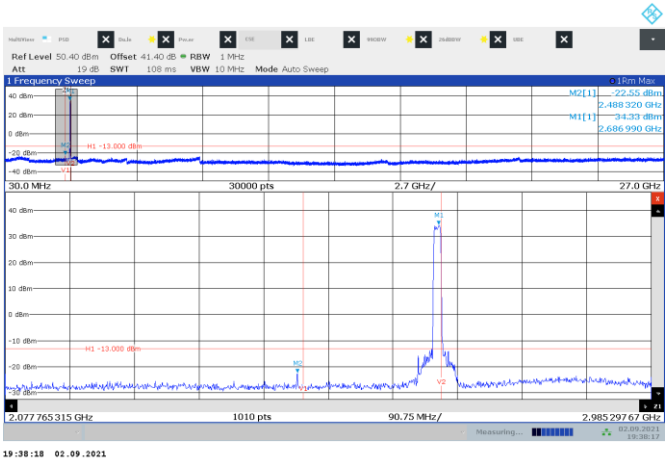


Figure 8.3-48: *Conducted spurious emissions at Ant 2 64QAM 10 MHz top channel*

Test data, continued

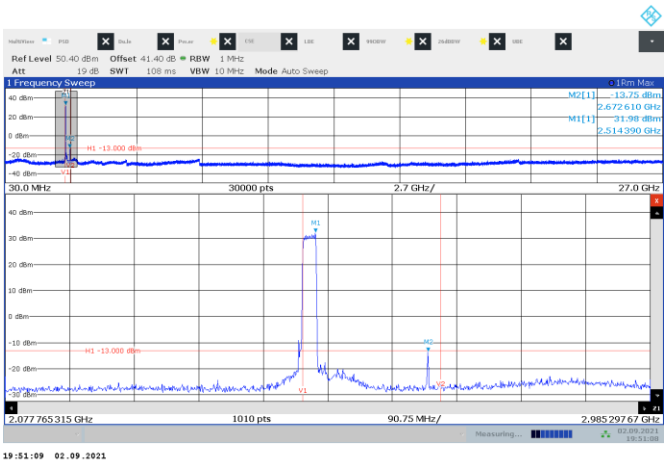


Figure 8.3-49 *Conducted spurious emissions at Ant 1 QPSK 20 MHz low channel*

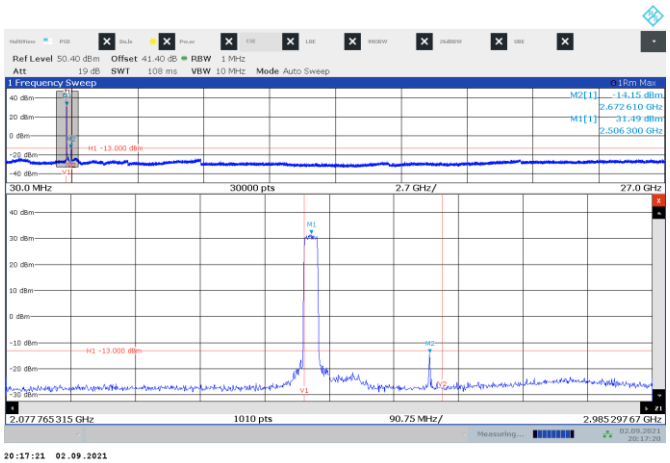


Figure 8.3-50: *Conducted spurious emissions at Ant 1 64QAM 20 MHz low channel*

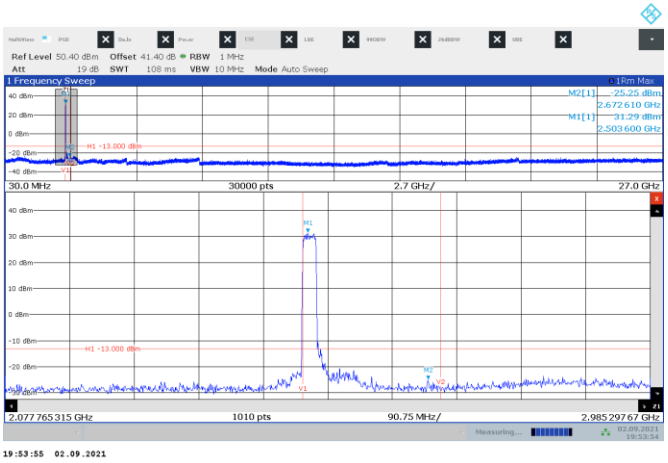


Figure 8.3-51 *Conducted spurious emissions at Ant 2 QPSK 20 MHz low channel*

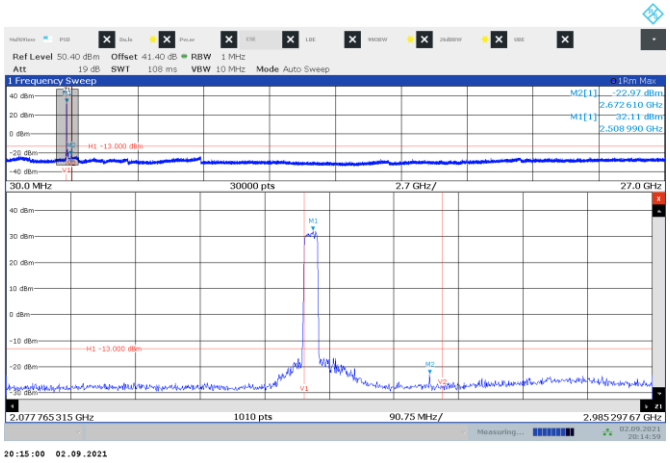


Figure 8.3-52: *Conducted spurious emissions at Ant 2 64QAM 20 MHz low channel*

Test data, continued

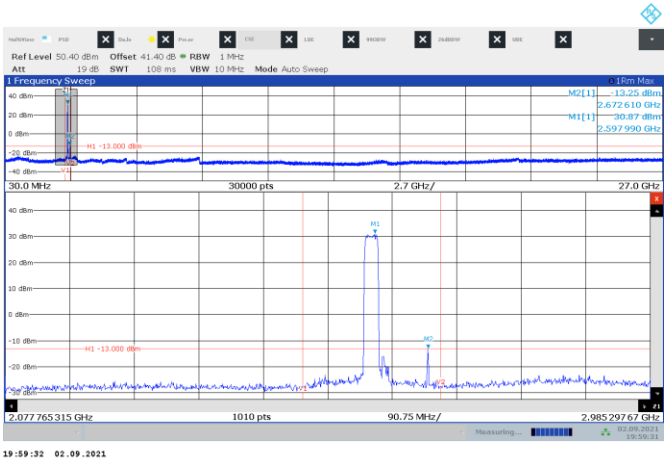


Figure 8.3-53 *Conducted spurious emissions at Ant 1 QPSK 20 MHz mid channel*

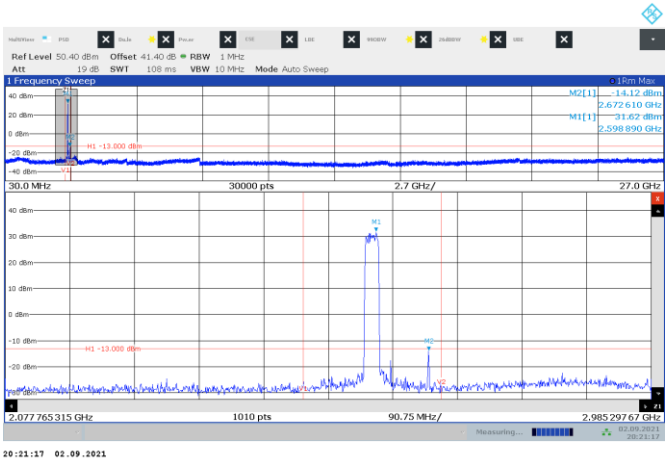


Figure 8.3-54: *Conducted spurious emissions at Ant 1 64QAM 20 MHz mid channel*

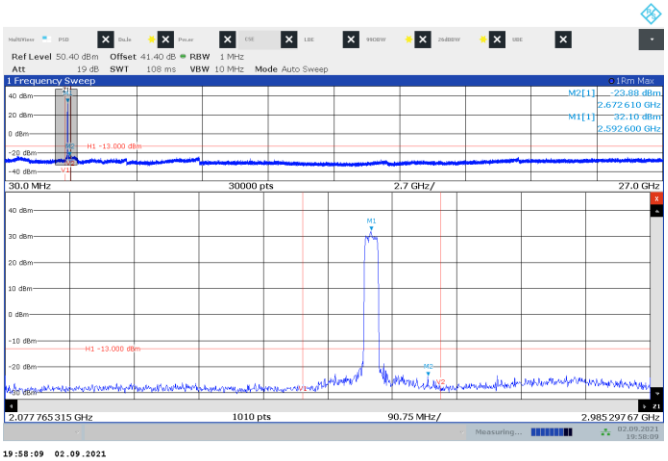


Figure 8.3-55 *Conducted spurious emissions at Ant 2 QPSK 20 MHz mid channel*

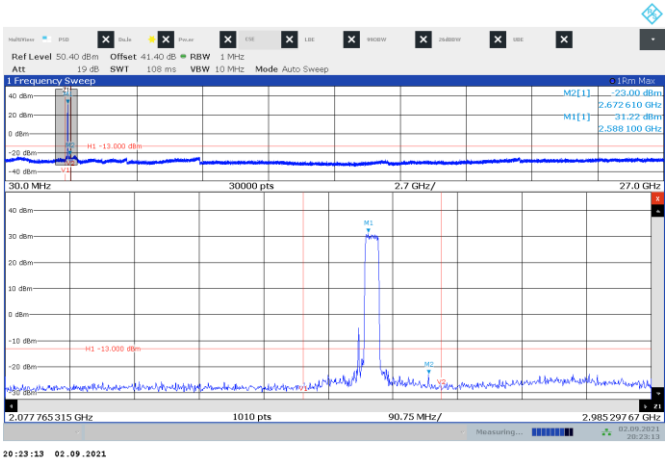


Figure 8.3-56: *Conducted spurious emissions at Ant 2 64QAM 20 MHz mid channel*

Test data, continued

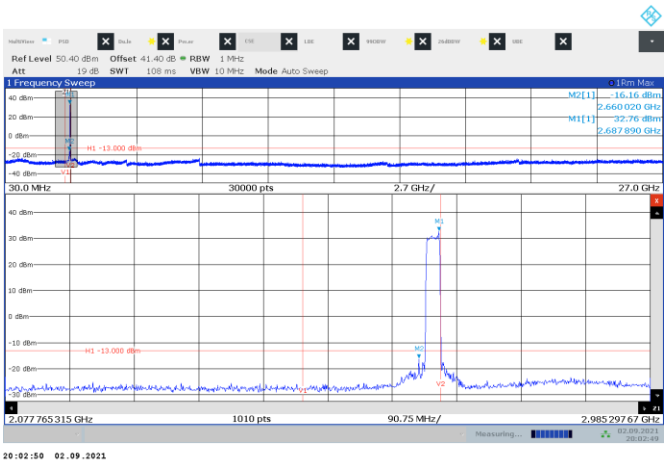


Figure 8.3-57 *Conducted spurious emissions at Ant 1 QPSK 20 MHz top channel*

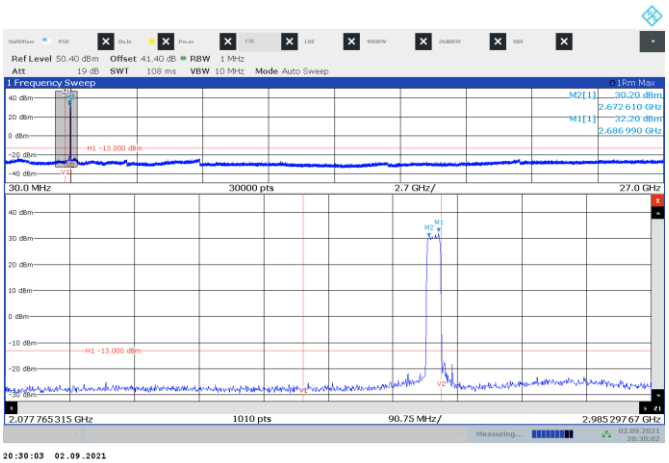


Figure 8.3-58: *Conducted spurious emissions at Ant 1 64QAM 20 MHz top channel*

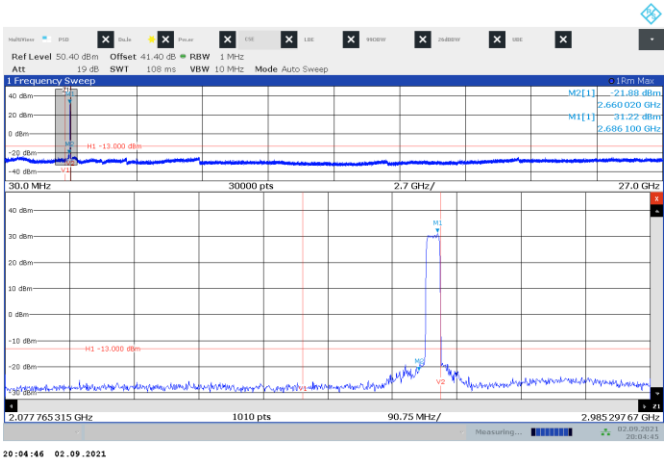


Figure 8.3-59 *Conducted spurious emissions at Ant 2 QPSK 20 MHz top channel*

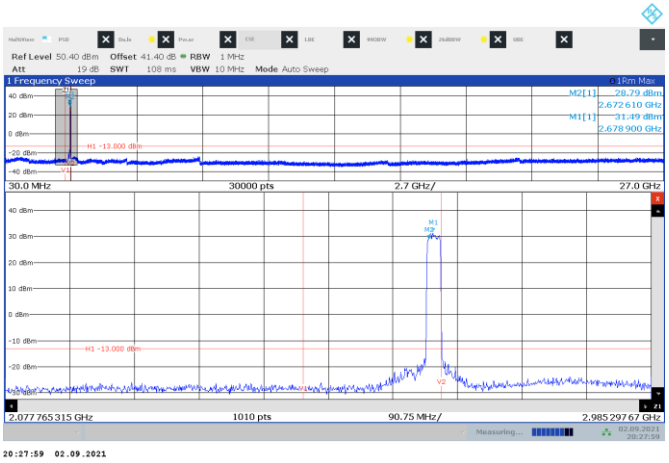


Figure 8.3-60: *Conducted spurious emissions at Ant 2 64QAM 20 MHz top channel*

Test data, continued

Table 8.3-7: *Cabinet radiation test results*

Channel	Frequency, MHz	EIRP, dBm	EIRP limit, dBm	Margin, dB
Low	4993.5	-41.39	-13.00	28.39
Low	7494.8	-15.43	-13.00	2.43
Low	9996.0	-33.33	-13.00	20.33
Low	12496.8	-38.48	-13.00	25.48
Low	14988.8	-39.67	-13.00	26.67
Mid	5188.5	-45.26	-13.00	32.26
Mid	7779.6	-26.96	-13.00	13.96
Mid	10372.8	-40.24	-13.00	27.24
Mid	12964.8	-39.46	-13.00	26.46
Mid	15553.6	-38.93	-13.00	25.93
Top	5375.0	-41.84	-13.00	28.84
Top	8064.4	-20.22	-13.00	7.22
Top	10752.8	-37.06	-13.00	24.06
Top	16127.2	-39.33	-13.00	26.33

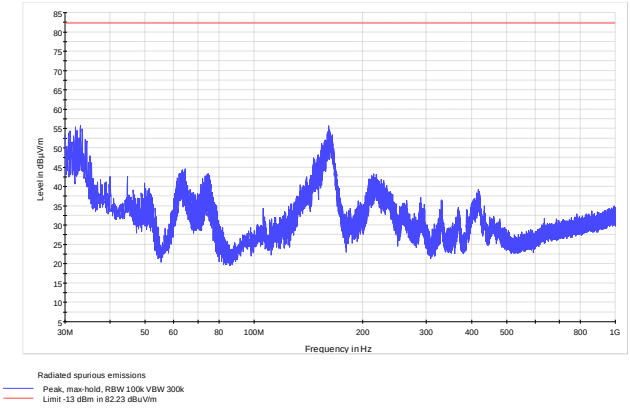


Figure 8.3-61 *Cabinet spurious radiations 30–1000 MHz for low channel*

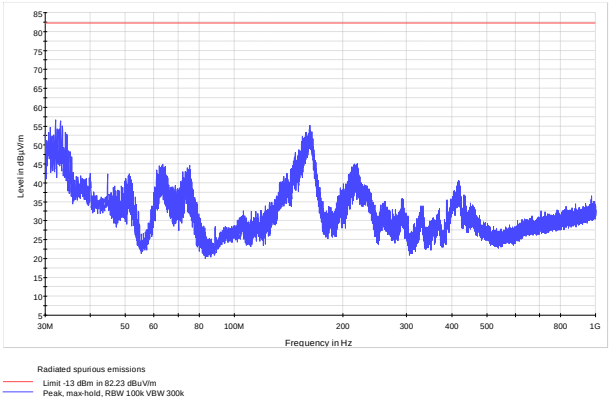


Figure 8.3-62: *Cabinet spurious radiations 30–1000 MHz for mid channel*

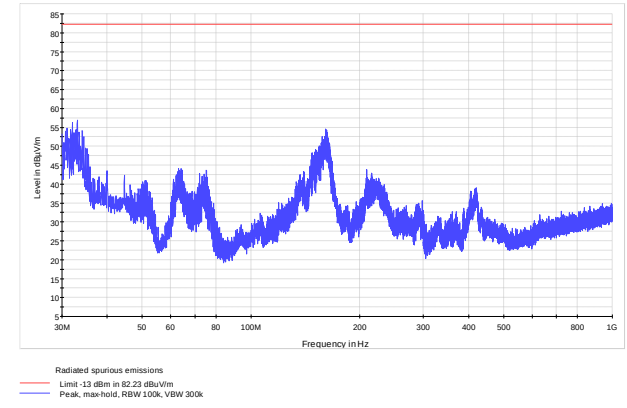


Figure 8.3-63 *Cabinet spurious radiations 30–1000 MHz for top channel*

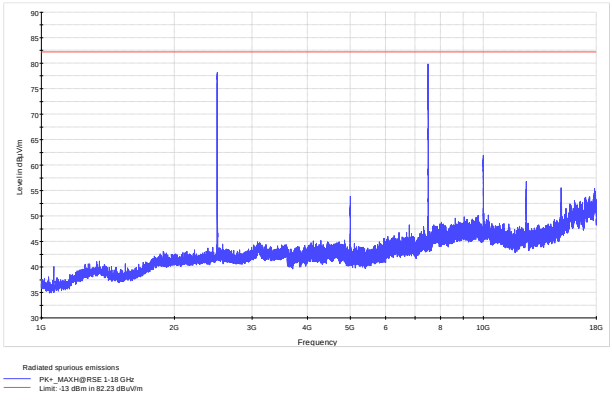


Figure 8.3-64: *Cabinet spurious radiations 1–18 GHz for low channel*

Test data, continued

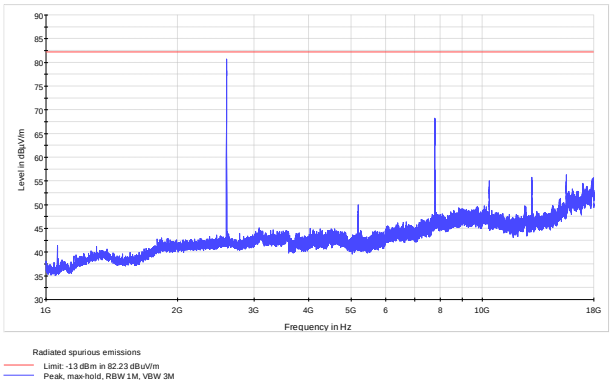


Figure 8.3-65 *Cabinet spurious radiations 1–18 GHz for mid channel*

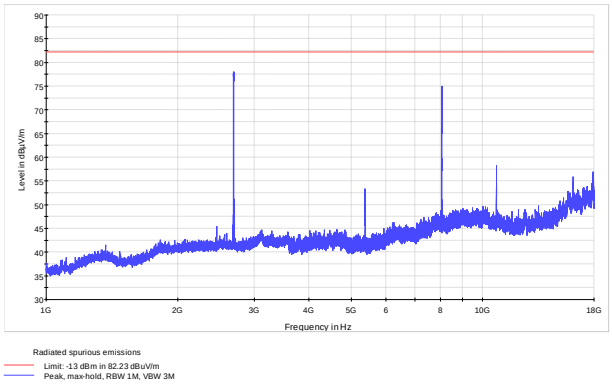


Figure 8.3-66: *Cabinet spurious radiations 1–18 GHz for top channel*

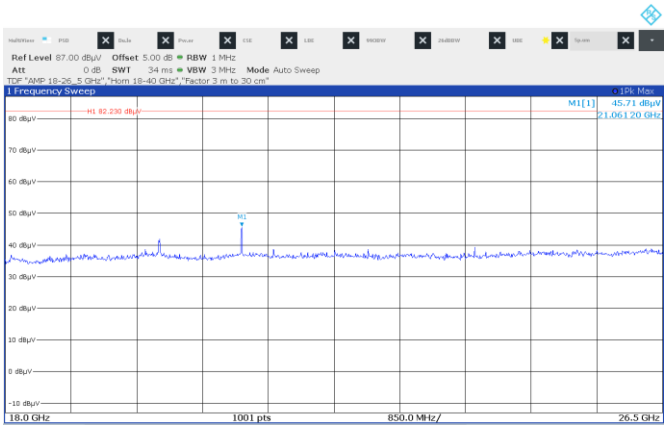


Figure 8.3-67 *Cabinet spurious radiations 18–26.5 GHz for low channel*

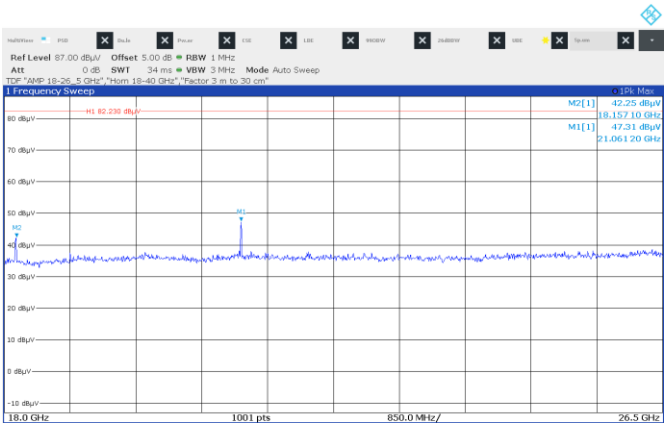


Figure 8.3-68 *Cabinet spurious radiations 18–26.5 GHz for mid channel*

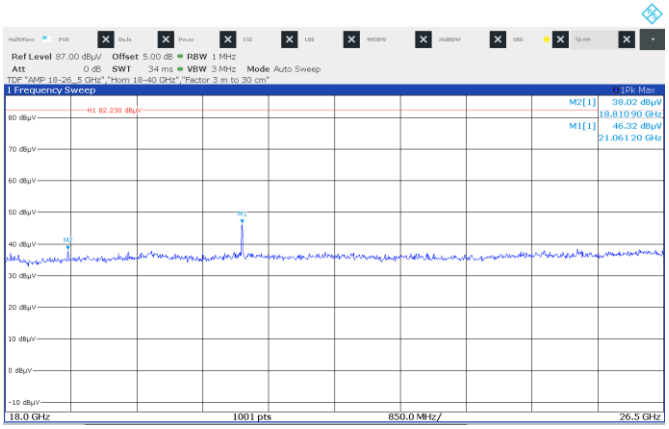


Figure 8.3-69 *Cabinet spurious radiations 18–26.5 GHz for top channel*

Note: 21 GHz area emission spike doesn't belong to the EUT.

8.4 Occupied bandwidth

8.4.1 References, definitions and limits

FCC §2.1049:

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.

8.4.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	September 2, 2021

8.4.3 Observations, settings and special notes

Emission bandwidth is measured based on ANSI C 63.26:2015 Clause 5.4.3 Occupied Bandwidth -Relative measurement procedure

Spectrum analyzer settings:

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

8.4.4 Test data

Table 8.4-1: *Occupied bandwidth measurements results for 5 MHz channel*

Antenna port	Modulation	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
1	QPSK	2498.5	4.83	4.50
1	QPSK	2593.0	4.84	4.48
1	QPSK	2687.5	4.84	4.48
2	QPSK	2498.5	4.89	4.49
2	QPSK	2593.0	5.16	4.49
2	QPSK	2687.5	4.83	4.50
1	64-QAM	2498.5	4.86	4.49
1	64-QAM	2593.0	4.83	4.49
1	64-QAM	2687.5	4.82	4.50
2	64-QAM	2498.5	4.84	4.49
2	64-QAM	2593.0	4.86	4.49
2	64-QAM	2687.5	4.80	4.50

Test data, continued

Table 8.4-2: *Occupied bandwidth measurements results for 10 MHz channel*

Antenna port	Modulation	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
1	QPSK	2501.0	9.65	9.00
1	QPSK	2593.0	9.67	8.96
1	QPSK	2685.0	9.59	9.00
2	QPSK	2501.0	9.63	8.98
2	QPSK	2593.0	9.65	8.99
2	QPSK	2685.0	9.59	8.97
1	64-QAM	2501.0	9.73	8.97
1	64-QAM	2593.0	9.73	8.98
1	64-QAM	2685.0	9.71	8.98
2	64-QAM	2501.0	9.67	9.00
2	64-QAM	2593.0	9.67	8.99
2	64-QAM	2685.0	9.61	8.98

Table 8.4-3: *Occupied bandwidth measurements results for 20 MHz channel*

Antenna port	Modulation	Frequency, MHz	26 dB BW, MHz	99% OBW, MHz
1	QPSK	2506.0	19.42	18.02
1	QPSK	2593.0	19.34	17.99
1	QPSK	2680.0	19.14	18.00
2	QPSK	2506.0	19.26	18.01
2	QPSK	2593.0	19.38	18.02
2	QPSK	2680.0	19.46	17.99
1	64-QAM	2506.0	19.38	18.00
1	64-QAM	2593.0	19.30	18.01
1	64-QAM	2680.0	19.46	18.01
2	64-QAM	2506.0	19.22	17.96
2	64-QAM	2593.0	19.34	17.97
2	64-QAM	2680.0	19.38	18.00

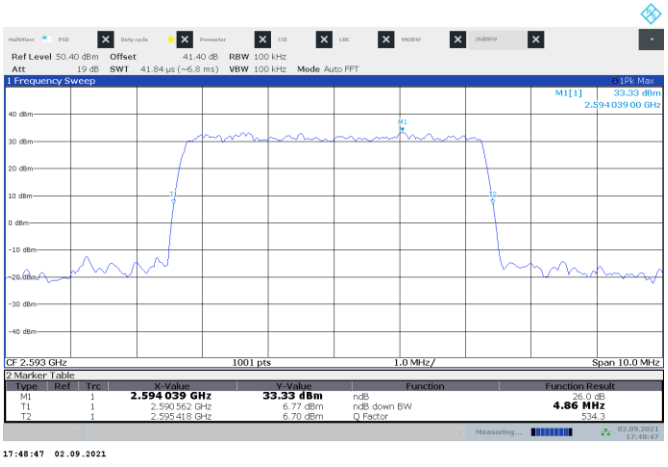


Figure 8.4-1: *26 dB sample plot for 5 MHz channel*

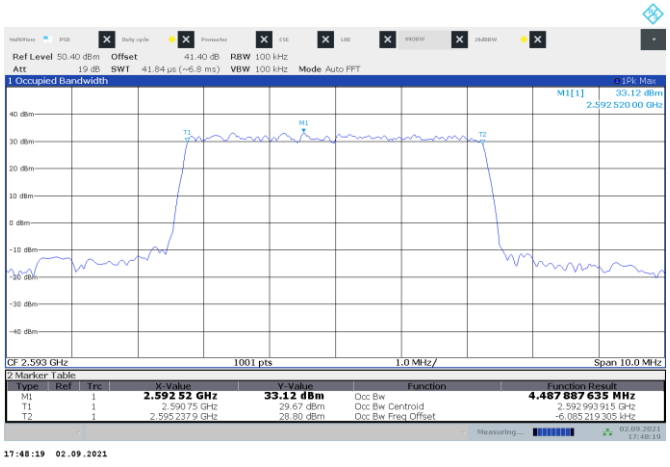


Figure 8.4-2: *99% OBW sample plot for 5 MHz channel*

Test data, continued

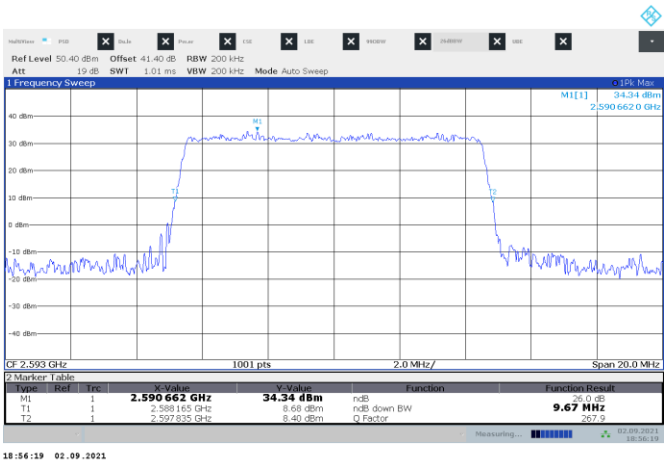


Figure 8.4-3: *26 dB sample plot for 10 MHz channel*

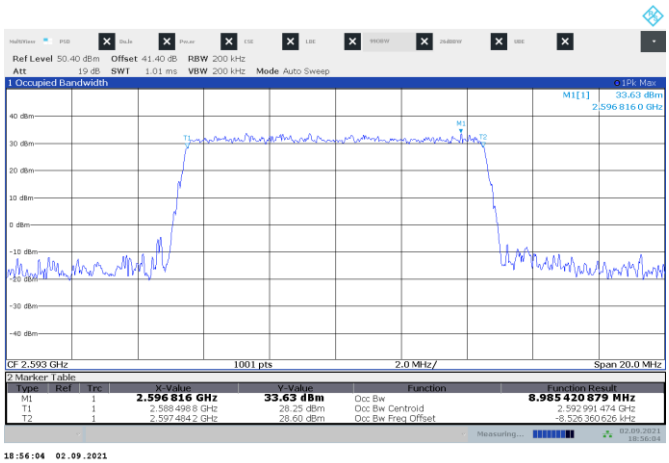


Figure 8.4-4: *99% OBW sample plot for 10 MHz channel*

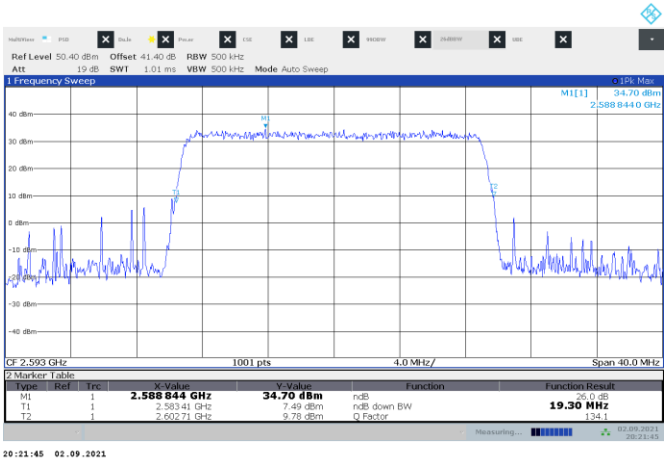


Figure 8.4-5: *26 dB sample plot for 20 MHz channel*

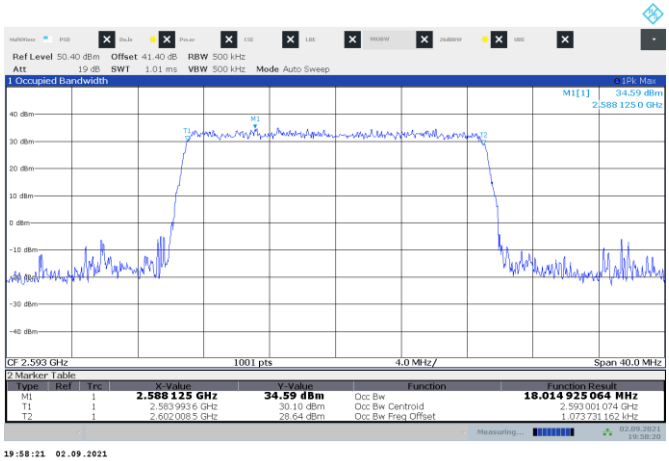


Figure 8.4-6: *99% OBW sample plot for 20 MHz channel*

8.5 Frequency stability

8.5.1 References, definitions and limits

FCC §27.54:

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

FCC §2.1055:

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

8.5.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	September 3, 2021

8.5.3 Observations, settings and special notes

Testing was performed using subclause 5.6 of ANSI C63.26-2015

8.5.4 Test data

Table 8.5-1: *Frequency drift*

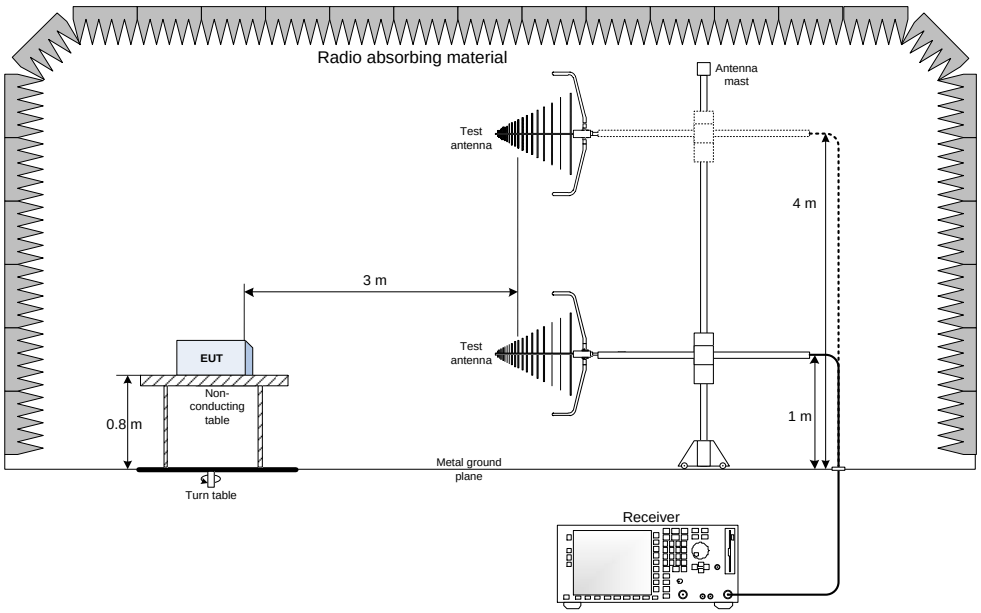
Test conditions	Frequency, Hz	Drift, Hz
+50 °C, Nominal voltage	2592999991.508	-1.498
+40 °C, Nominal voltage	2592999993.007	-2.997
+30 °C, Nominal voltage	2592999991.508	-1.498
+20 °C, Nominal voltage +15 %	2592999992.008	-1.998
+20 °C, Nominal voltage	2592999990.010	*Reference*
+20 °C, Nominal voltage −15 %	2592999992.008	-1.998
+10 °C, Nominal voltage	2592999992.008	-1.998
0 °C, Nominal voltage	2592999993.506	-3.496
−10 °C, Nominal voltage	2592999992.507	-2.497
−20 °C, Nominal voltage	2592999992.008	-1.998
−30 °C, Nominal voltage	2592999992.507	-2.497

Test results.

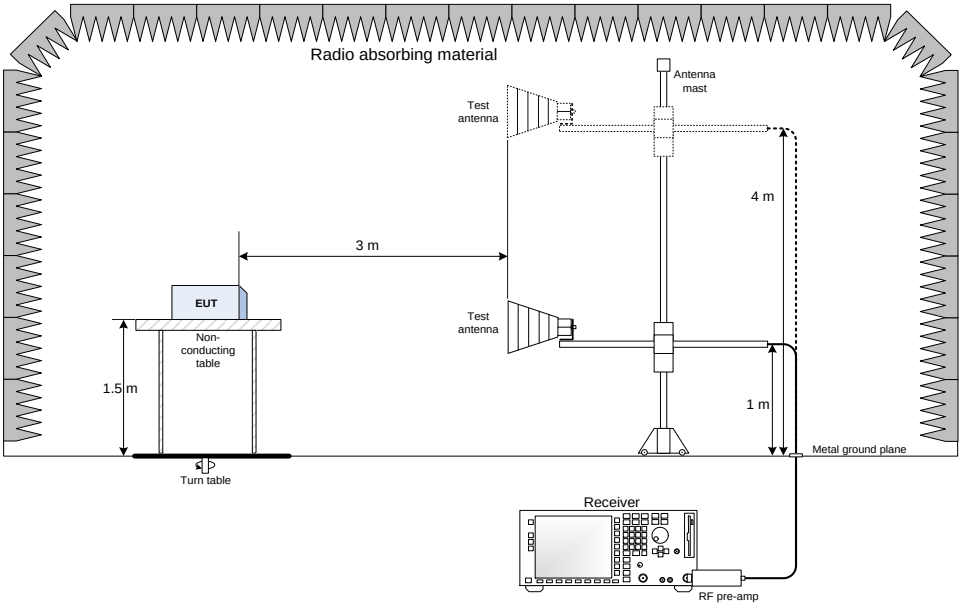
Largest positive measured frequency drift was 0 Hz. Largest negative measured frequency drift was −3.496 Hz.

Section 9. Block diagrams of test set-ups

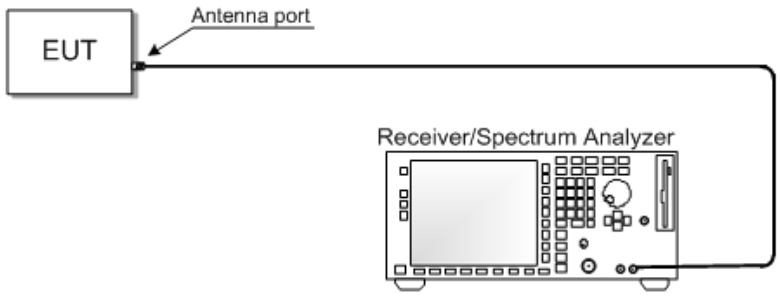
9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Conducted emissions set-up



-End of test report -