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RADIO TEST REPORT – 398788-2TRFWL

Type of assessment:

Final product testing

Applicant:

Intracom S.A. Telecom Solutions

Product:

Point-to-Multipoint Gigabit Radio 28 GHz

Model:

OSDR-28-L-1008-02

Model variant:

OSDR-28

FCC ID:

2AHZC-OSDR28L100802

Brand:

WiBAS

Specifications:

- FCC 47 CFR Part 30, Subpart C

Date of issue: July 27, 2020

Andrey Adelberg, Senior EMC/RF Specialist
Tested by


Signature

David Duchesne, EMC/RF Lab Manager
Reviewed by


Signature

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Test site identifier	**Organization**	**Ottawa/Almonte**	**Montreal**	**Cambridge**
	FCC:	CA2040	CA2041	CA0101
	ISED:	2040ª-4	2040G-5	24676
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 30, Subpart C	Upper Microwave Flexible Use Service

1.2 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCC 47 CFR Part 2, Subpart J	Equipment authorization procedures
KDB 971168 D01	Power Meas License Digital Systems v03r01
KDB 842590 D01	Upper Microwave Flexible Use Service v01r01

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	July 27, 2020	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 can operate with modulations up to 1024-QAM. However everything was tested with 4-QAM operation, which was verified as a worst case in respect to the performance, power and emissions.

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. Information provided by the applicant

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	Intracom S.A. Telecom Solutions
Applicant address	19.7 km Markopoulou Ave., Peania, Athens GR-19002 Greece
Manufacture name and address	Same as applicant

5.3 EUT information

Product	Point-to-Multipoint Gigabit Radio 28 GHz (TS)
Model	OSDR-28-L-1008-02
Model variant	OSDR-28
Brand	WiBAS
Serial number	321810988974
Part number	KZ00-659/83.R3
Power supply requirements	AC: 90–240 V_{AC} 50/60 Hz (via PoE) or DC: −48 V_{DC} (via PONE)
Product description and theory of operation	WiBAS™-OSDR is an all-outdoor hub radio operating at area-licensed band (28 GHz) offering the highest capacity and the most dense PtMP deployment available in the market. This radio delivers state-of-the-art IP connectivity for Fixed Wireless Access (FWA) networks and perfectly suits the operator needs for zero-footprint installations at homes and business subscriber locations. It is based on a software defined radio platform, which provides future-proof deployments and feature enhancements through software licensing. WiBAS™-OSDR combines sophisticated QoS features and robust performance with a highly-efficient operation. The electronics – baseband unit / modem / controller and radio circuitry – are all securely accommodated in a lightweight, environmentally hardened housing that is directly coupled to the antenna. Service area can extend more than 10 km from the hub location (clear sky conditions).

5.4 Radio technical information

Operating band	27.5–28.35 GHz
Frequency Min (MHz)	28,122.50
Frequency Max (MHz)	28,213.50
RF power Max (W), Conducted	0.731 (28.64 dBm)
Field strength, dBµV/m @ 3 m	N/A
Measured BW (kHz), 99% OBW	53205
Type of modulation	Up to 256-QAM
Emission classification	W7D
Transmitter spurious, dBµV/m @ 3 m	79.43 at 98.85 GHz
Antenna information	Parabolic 30 cm MN: THP 03 275 S by faini telecommunication systems with 38.5 dBi maximum gain Parabolic 60 cm MN: THP 06 275 S by faini telecommunication systems with 43.2 dBi maximum gain

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	EUT was controlled from external PC using Telnet session. Channel BW of 56 MHz, Power setting of 26 dBm System SW Release: 7.1.0_2302_B.3.2.0.build_07 Use a PC to manage the equipment, for specific tests, the low-level telnet is required. The PC must have an IP (for example) 10.10.10.200 255.255.255.0 Use of a telnet: PuTTY or other software for telnet using the equipment IP Username: admin Password: admin The units have the following IP addresses: Low Unit: TS: 10.10.10.101 Commands: modify wphy modemconf bw 56mhz (after this command the system asks for "config save" and then "reboot system". This command is not necessary if don't want to change modulation. The system has already 56mhz saved.) modify wphy rfuscan scanid 1 rxfreq 29228000 scanstatus disable (Disables TS to try frequency pair to lock to the BS. It is a must command, if want to execute the following test modes) test mode freq_stability: modify wphy test-mode state carrier tx-frequency 28220000 test mode Spur & Tx_Power: modify wphy test-mode state continuous-tx bw 56mhz phymode 4qam tx-frequency 28220000 tx-power 26

5.5.2 EUT setup configuration

Table 5.5-1: *EUT interface ports*

Description	Qty.
GbE (RJ-45) Traffic / inband NMS / PoE input	1
GbE (SFP) Traffic / inband NMS	1
GbE (RJ-45) OSDR protection	1
FE (RJ-45) Outband NMS / PoE input	1
GbE (RJ-45) Reserved	1

Table 5.5-2: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
POE	Intracom	SN: PT1936210309, MN: PT-PSE106GWN-AR, Ver. 5.0, OC: POE-ID-AC72
PONE injector, outdoor	Intracom	SN: 321904188530; MN: PONE-OD-DC; PN: KZ00-65A/60.39
Laptop	Dell	Nemko Asset: FA002852

EUT setup configuration, cintinued

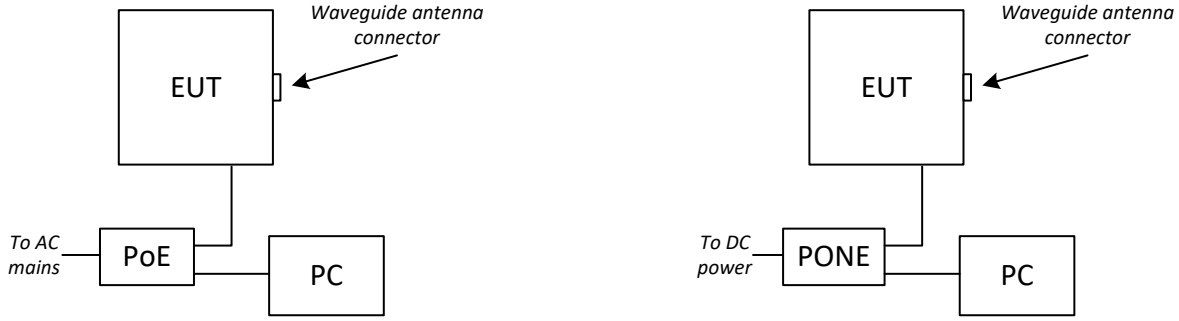


Figure 5.5-1: *Setup block diagram*

Section 6. Summary of test results

6.1 Testing location

Test location (s)	Ottawa

6.2 Testing period

Test start date	May 25, 2020	Test end date	May 29, 2020

6.3 Sample information

Receipt date	May 21, 2020	Nemko sample ID number(s)	2

6.4 FCC Part 101 requirements test results

Table 6.4-1: *FCC requirements results*

FCC P30 Paragraph	FCC P2 Paragraph	Test description	Verdict
§30.402	§2.1055	Frequency stability	Pass
§30.403	§2.1049	Occupied Bandwidth	Pass
§30.203, 30.204	§2.1053	Spurious Emissions	Pass
§30.202	§2.1051	RF Power Output	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	January 24, 2021
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
61505 AC source	Chroma	61509	FA003036	—	VOU
DC Power source	Ametek	SGA80X125C-0AAA	FA002737	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 8, 2020
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	October 31, 2020
Horn (1–18 GHz)	ETS Lindgren	3117	FA002840	1 year	January 25, 2021
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002873	1 year	November 4, 2020
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	January 14, 2021
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	November 7, 2020
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU
40–60 GHz Harmonic mixer	OML	WR19 M19HWD	FA002322	3 year	July 29, 2022
40–60 GHz Standard gain horn	Millitech	U SGH-19	FA002322a	—	VOU
60–90 GHz Harmonic mixer	OML	WR12 M12HWD	FA001524	3 year	July 29, 2022
60–90 GHz Standard gain horn	Millitech	U SGH-12	FA001524a	—	VOU
90–140 GHz Harmonic mixer	OML	WR08 M08HWD	FA001525	3 year	July 29, 2022
90–140 GHz Standard gain horn	Millitech	U SGH-08	FA001525a	—	VOU
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	January 7, 2021

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	May 25, 2020

8.1.3 Observations, settings and special notes

None

8.1.4 Test data

Table 8.1-2: *Test channels selection*

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
27500.000	28350.000	850	28122.500	28171.500	28213.500

8.2 Power limits

8.2.1 References, definitions and limits

FCC §30.202:

(a) For fixed and base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75 dBm/100 MHz. For channel bandwidths less than 100 megahertz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 megahertz.

(b) For mobile stations, the average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

(c) For transportable stations, as defined in §30.2, the average power of the sum of all antenna elements is limited to a maximum EIRP of +55 dBm (85 dBm).

(d) For fixed point-to-point and point-to-multipoint limits see §30.405.

FCC §30.405:

On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the Maximum Allowable EIRP of +55 dBW (85 dBm) within 27.5–28.35 GHz band. For Point-to-multipoint user stations authorized in this band, the EIRP shall not exceed 55 dBW (85 dBm) or 42 dBW/MHz (72 dBm/MHz).

8.2.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	May 26, 2020

8.2.3 Observations, settings and special notes

Power spectral density was done using the following settings:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 MHz
Frequency span:	5 GHz
Detector mode:	RMS
Trace mode:	Power average
Power aggregation	Over 56 MHz channel bandwidth

8.2.4 Test data

Table 8.2-1: *EIRP measurements results for THP 03 275 S antenna variant*

Frequency, GHz	Conducted power, dBm	Max antenna gain, dBi	EIRP, dBm	EIRP, dBW	EIRP limit, dBW	EIRP margin, dB
28125.500	28.64	38.50	67.14	37.14	55.00	17.86
28171.500	28.36	38.50	66.86	36.86	55.00	18.14
28213.500	28.44	38.50	66.94	36.94	55.00	18.06

Table 8.2-2: *EIRP measurements results for THP 06 275 S antenna variant*

Frequency, GHz	Conducted power, dBm	Max antenna gain, dBi	EIRP, dBm	EIRP, dBW	EIRP limit, dBW	EIRP margin, dB
28125.500	28.64	43.20	71.84	41.84	55.00	13.16
28171.500	28.36	43.20	71.56	41.56	55.00	13.44
28213.500	28.44	43.20	71.64	41.64	55.00	13.36

Table 8.2-3: *EIRP density measurements results for THP 03 275 S antenna variant*

Frequency, GHz	Conducted power density, dBm/MHz	Max antenna gain, dBi	EIRP density, dBm/MHz	EIRP density, dBW/MHz	EIRP density limit, dBW/MHz	EIRP margin, dB
28125.500	12.75	38.50	51.25	21.25	42.00	20.75
28171.500	12.46	38.50	50.96	20.96	42.00	21.04
28213.500	12.37	38.50	50.87	20.87	42.00	21.13

Table 8.2-4: *EIRP density measurements results for THP 06 275 S antenna variant*

Frequency, GHz	Conducted power density, dBm/MHz	Max antenna gain, dBi	EIRP density, dBm/MHz	EIRP density, dBW/MHz	EIRP density limit, dBW/MHz	EIRP margin, dB
28125.500	12.75	43.20	55.95	25.95	42.00	16.05
28171.500	12.46	43.20	55.66	25.66	42.00	16.34
28213.500	12.37	43.20	55.57	25.57	42.00	16.43

Test data, continued

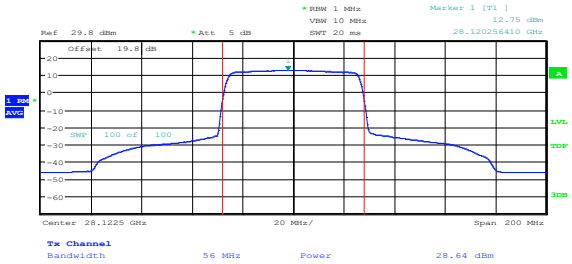


Figure 8.2-1: *Power and PSD on low channel*

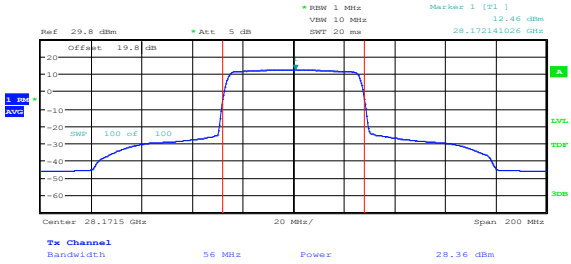


Figure 8.2-2: *Power and PSD on mid channel*

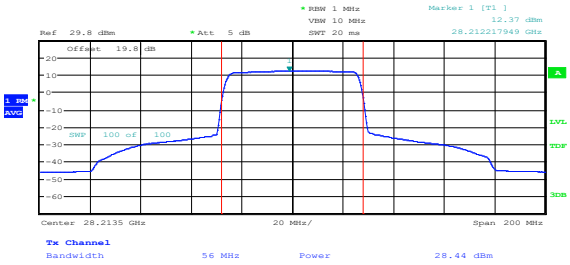


Figure 8.2-3: *Power and PSD on high channel*

8.3 Emission limitations

8.3.1 References, definitions and limits

FCC §30.203:

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

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

(3) The measurements of emission power can be expressed in peak or average values.

(c) For fixed point-to-point and point-to-multipoint limits see §30.404.

FCC §30.204:

Field strength limits

(a) Base/mobile operations: The predicted or measured Power Flux Density (PFD) from any Base Station operating in the 27.5–28.35 GHz band at any location on the geographical border of a licensee's service area shall not exceed −76 dBm/m^2/MHz (measured at 1.5 meters above ground) unless the adjacent affected service area licensee(s) agree(s) to a different PFD.

(b) Fixed point-to-point operations.

(1) Prior to operating a fixed point-to-point transmitting facility in the 27.5–28.35 GHz band where the facilities are located within 20 kilometers of the boundary of the licensees authorized market area, the licensee must complete frequency coordination in accordance with the procedures specified in §101.103(d)(2) of this chapter with respect to neighboring licensees that may be affected by its operations.

FCC §30.404:

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(2) When using transmissions employing digital modulation techniques in situations not covered in this section:

(i) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 11 decibels:

$A = 11 + 0.4(P-50) + 10\times\text{Log}_{10} B$. (Attenuation greater than 56 decibels or to an absolute power of less than −13 dBm/MHz is not required.)

(ii) In any 1 MHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10\times\text{Log}_{10}$ (the mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation. The authorized bandwidth includes the nominal radio frequency bandwidth of an individual transmitter/modulator in block-assigned bands.

(iii) The emission mask in paragraph (a)(2)(i) of this section applies only to the band edge of each block of spectrum, but not to subchannels established by licensees. The value of P in the equation is the percentage removed from the carrier frequency and assumes that the carrier frequency is the center of the actual bandwidth used. The emission mask can be satisfied by locating a carrier of the subchannel sufficiently far from the channel edges so that the emission levels of the mask are satisfied. The emission mask shall use a value B (bandwidth) of 40 MHz, for all cases even in the case where a narrower subchannel is used (for instance the actual bandwidth is 10 MHz) and the mean output power used in the calculation is the sum of the output power of a fully populated channel. For block assigned channels, the out-of-band emission limits apply only outside the assigned band of operation and not within the band.

8.3.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	May 26, 2020

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 100 GHz. No unintentional emissions were detected.
Measurement distances used were: 1–18 GHz at 3 m, 18–40 GHz at 1 m, 40–100 GHz at 0.03 m.
A 50-ohm matching impedance network and attenuation was used during testing. Cabinet radiation was done with antenna port terminated with 50-ohm load.
Authorized channel bandwidth is 56 MHz. 250% of the authorized bandwidth is 56 × 2.5 = 140 MHz.
OOB frequencies calculation:
27.500 GHz − 140 MHz = 27.660 GHz.
28.350 GHz + 140 MHz = 28.490 GHz

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

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

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

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

8.3.4 Test data

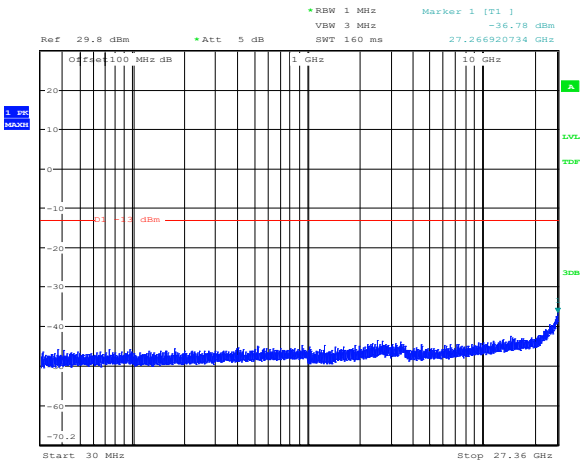


Figure 8.3-1: *Conducted spurious emissions 30 MHz to 27.36 GHz at low channel*

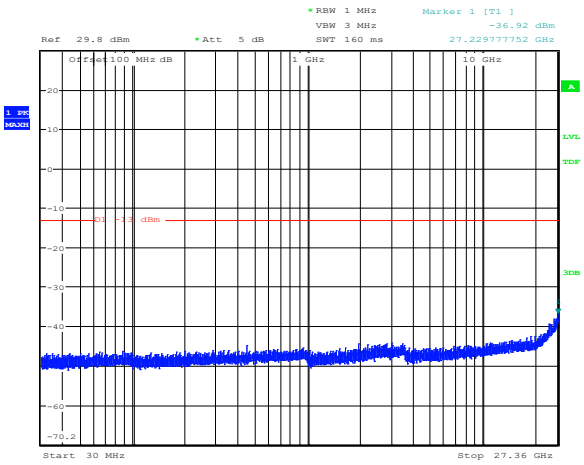


Figure 8.3-2: *Conducted spurious emissions 30 MHz to 27.36 GHz at mid channel*

Test data, continued

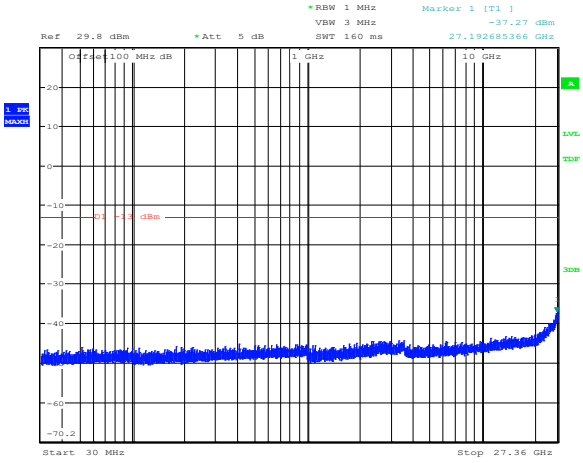


Figure 8.3-3: *Conducted spurious emissions 30 MHz to 27.36 GHz at high channel*

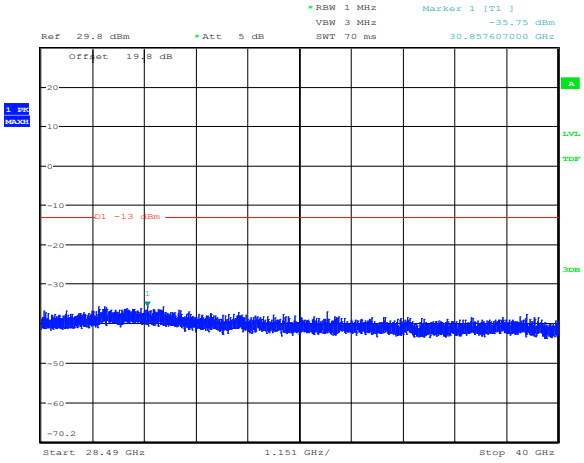


Figure 8.3-4: *Conducted spurious emissions 28.49–40 GHz at low channel*

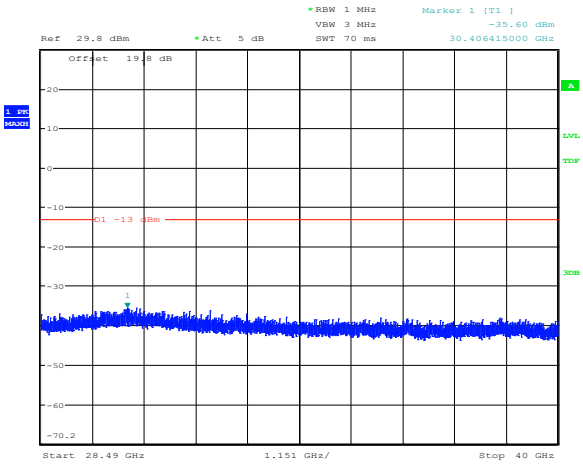


Figure 8.3-5: *Conducted spurious emissions 28.49–40 GHz at mid channel*

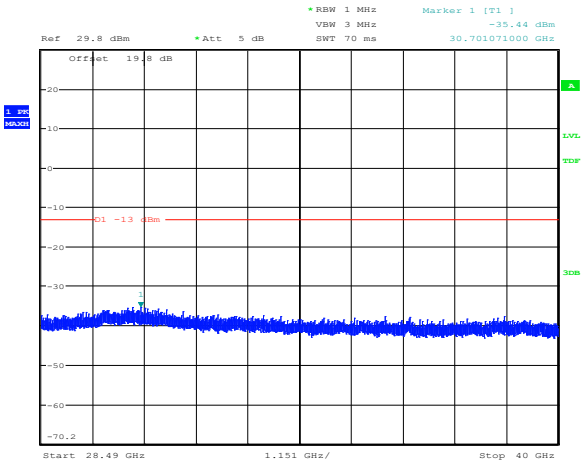


Figure 8.3-6: *Conducted spurious emissions 28.49–40 GHz at high channel*

Test data, continued

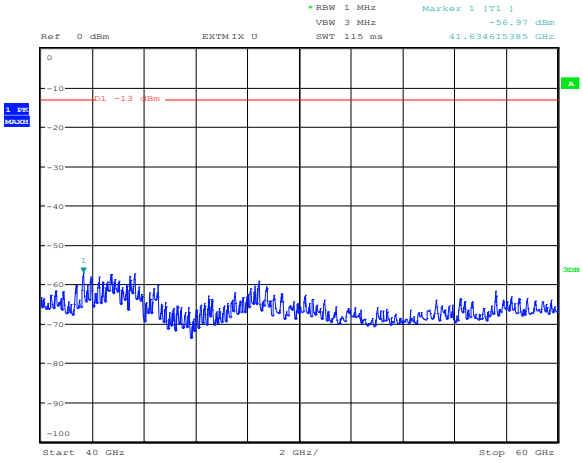


Figure 8.3-7: *Conducted spurious emissions 40–60 GHz at low channel*

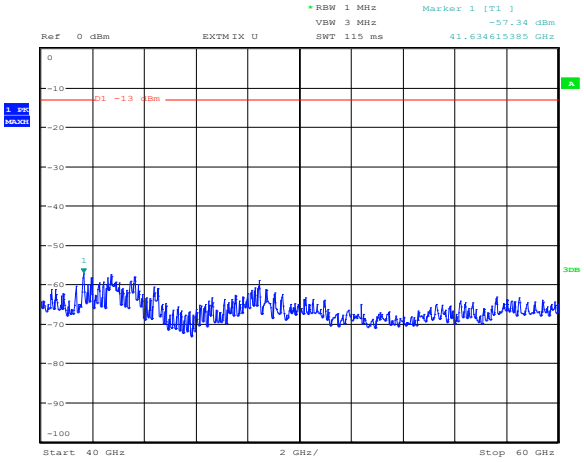


Figure 8.3-8: *Conducted spurious emissions 40–60 GHz at mid channel*

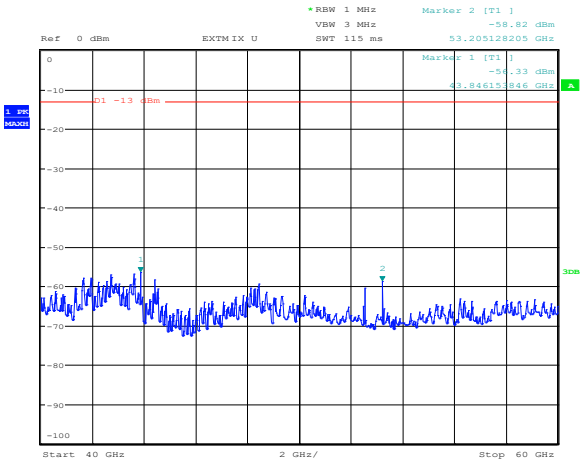


Figure 8.3-9: *Conducted spurious emissions 40–60 GHz at high channel*

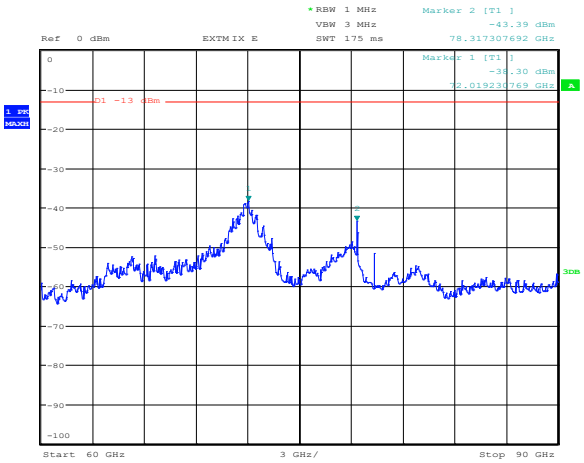


Figure 8.3-10: *Conducted spurious emissions 60–90 GHz at low channel*

Test data, continued

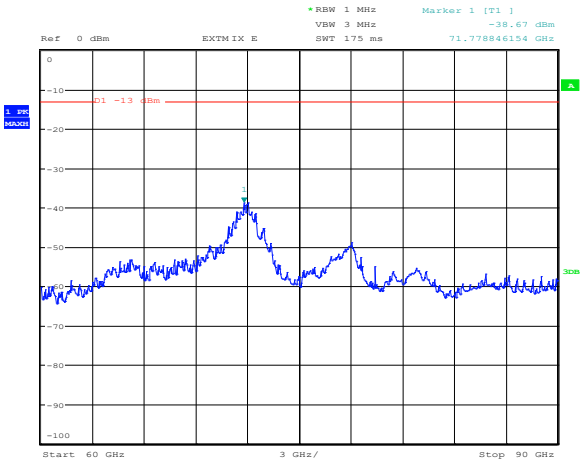


Figure 8.3-11: *Conducted spurious emissions 60–90 GHz at mid channel*

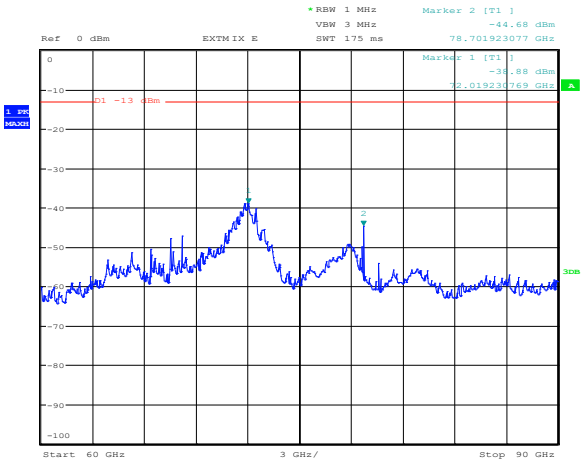


Figure 8.3-12: *Conducted spurious emissions 60–90 GHz at high channel*

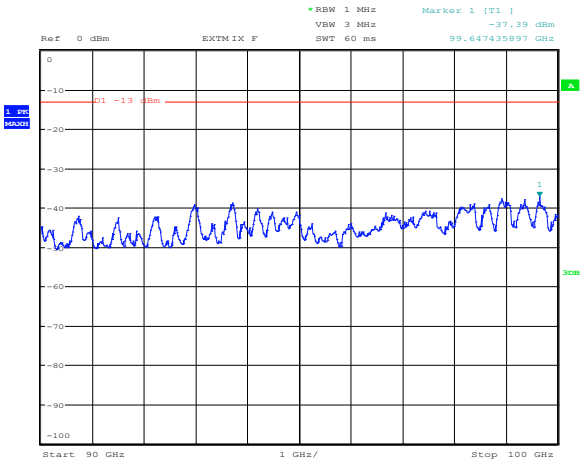


Figure 8.3-13: *Conducted spurious emissions 90–100 GHz at low channel*

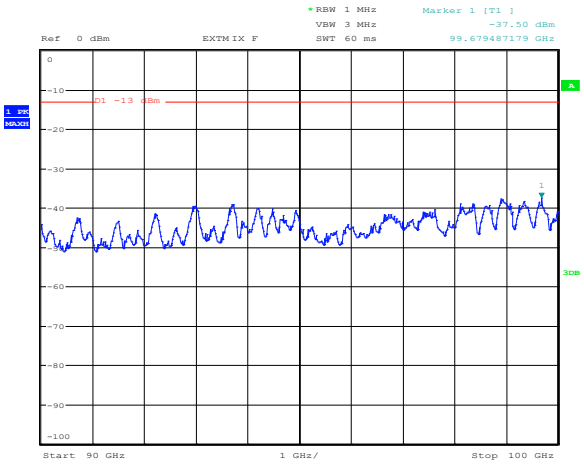


Figure 8.3-14: *Conducted spurious emissions 90–100 GHz at mid channel*

Test data, continued

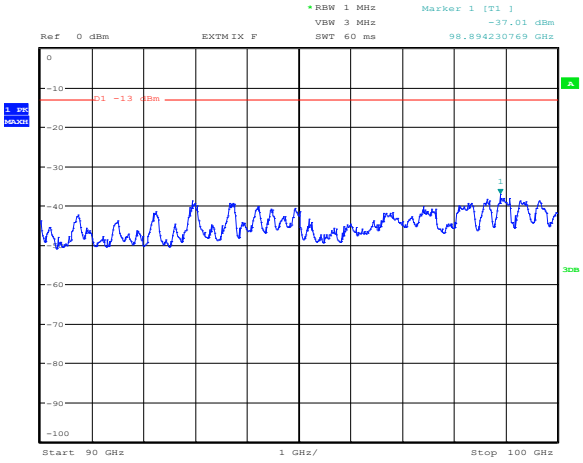


Figure 8.3-15: *Conducted spurious emissions 90–100 GHz at high channel*

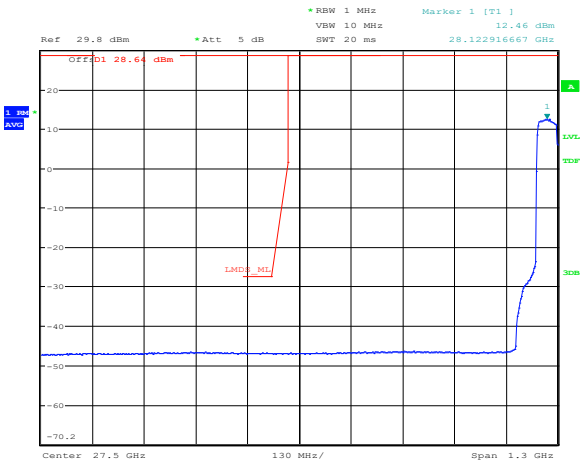


Figure 8.3-16: *Emission mask at low channel*

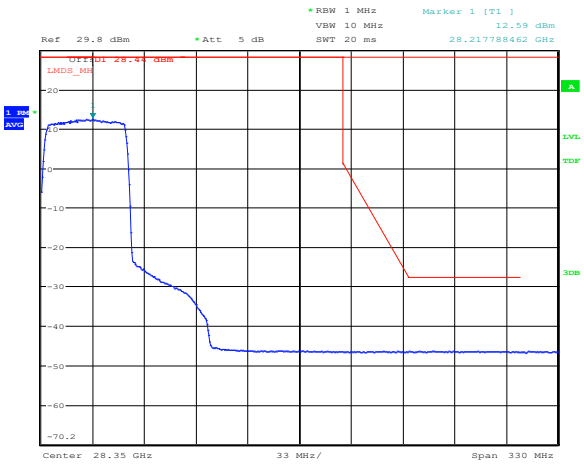


Figure 8.3-17: *Emission mask at high channel*

Test data, continued

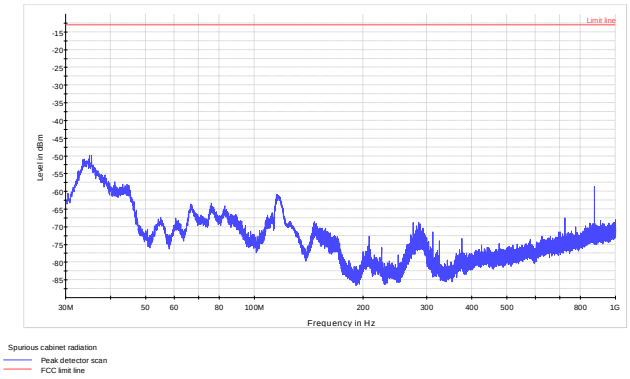


Figure 8.3-18: *Radiated spurious emissions 30–1000 MHz, low channel*

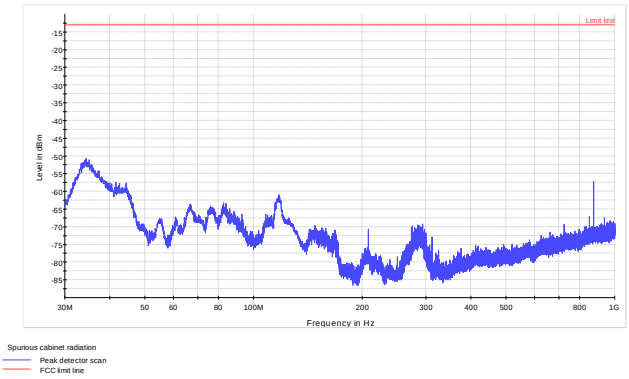


Figure 8.3-19: *Radiated spurious emissions 30–1000 MHz, mid channel*

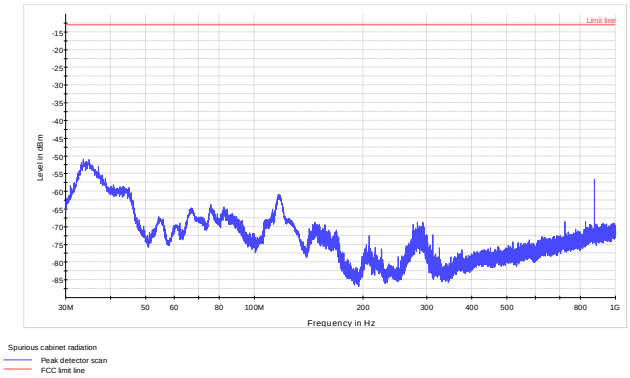


Figure 8.3-20: *Radiated spurious emissions 30–1000 MHz, high channel*

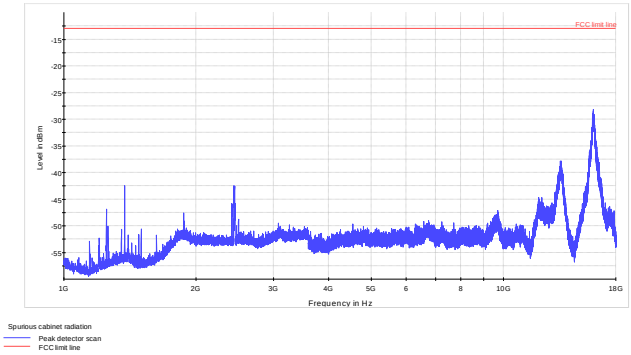


Figure 8.3-21: *Radiated spurious emissions 1–18 GHz, low channel*

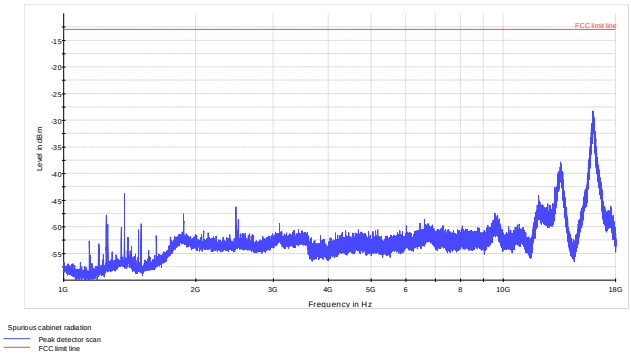


Figure 8.3-22: *Radiated spurious emissions 1–18 GHz, mid channel*

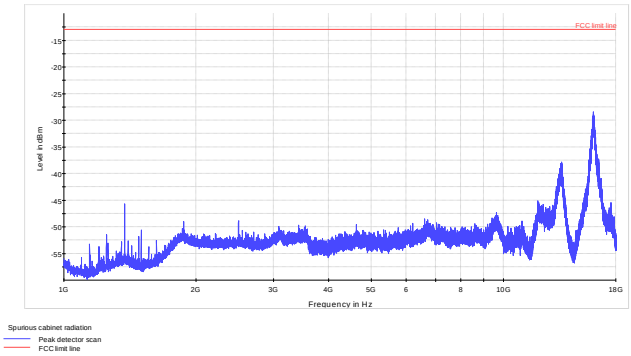


Figure 8.3-23: *Radiated spurious emissions 1–18 GHz, high channel*

Test data, continued

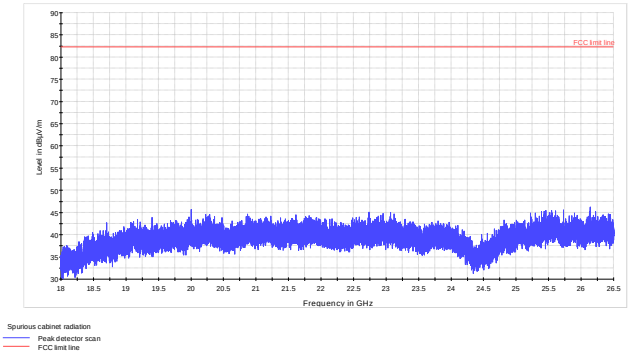


Figure 8.3-24: *Radiated spurious emissions 18–26.5 GHz, low channel*

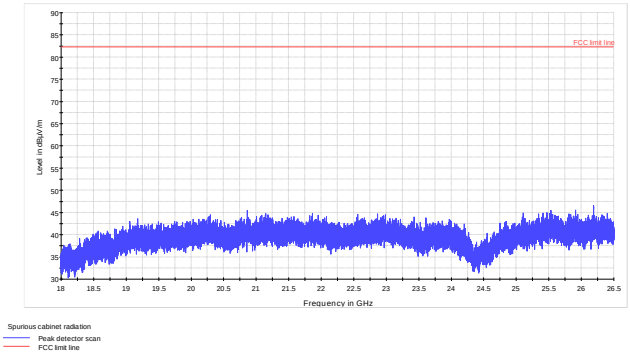


Figure 8.3-25: *Radiated spurious emissions 18–26.5 GHz, mid channel*

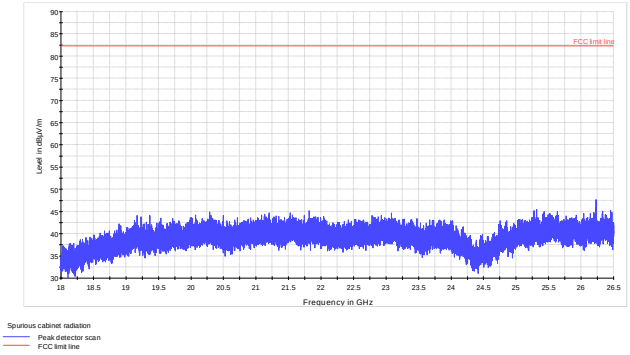


Figure 8.3-26: *Radiated spurious emissions 18–26.5 GHz, high channel*

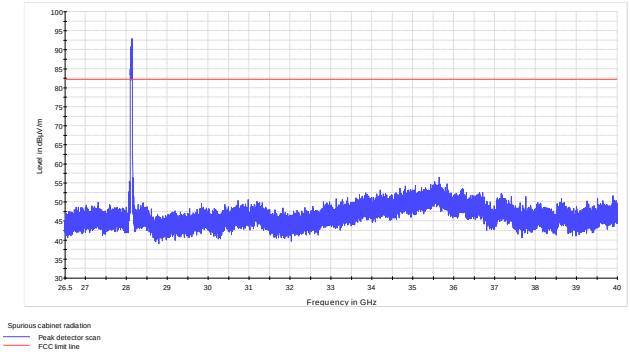


Figure 8.3-27: *Radiated spurious emissions 26.5–40 GHz, low channel*

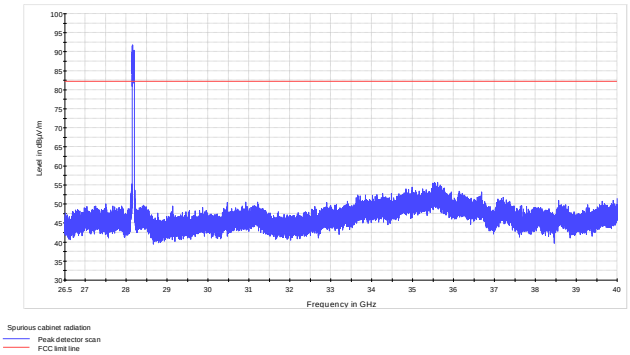


Figure 8.3-28: *Radiated spurious emissions 26.5–40 GHz, mid channel*

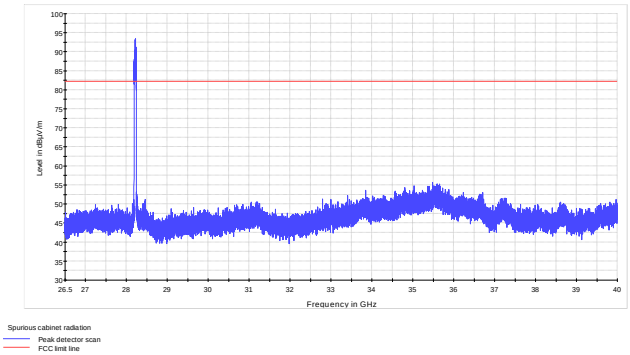


Figure 8.3-29: *Radiated spurious emissions 26.5–40 GHz, high channel*

Test data, continued

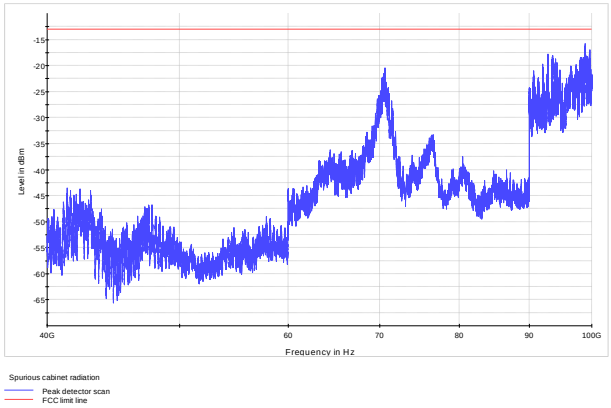


Figure 8.3-30: *Radiated spurious emissions 40–100 GHz, low channel*

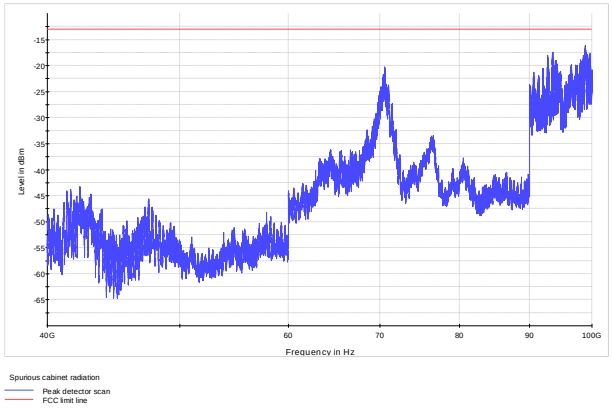


Figure 8.3-31: *Radiated spurious emissions 40–100 GHz, mid channel*

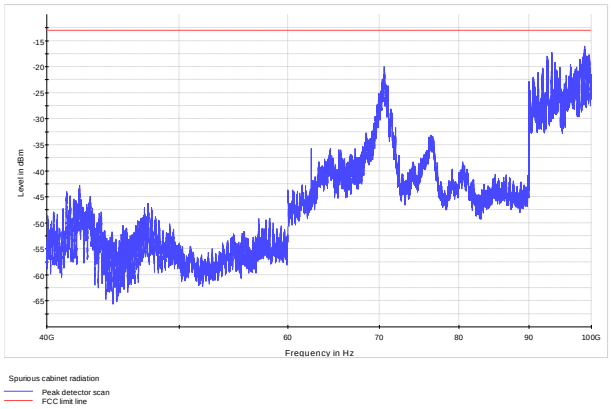


Figure 8.3-32: *Radiated spurious emissions 40–100 GHz, high channel*

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.

FCC §30.403:

(a) Stations under this subpart will be authorized any type of emission, method of modulation, and transmission characteristic, consistent with efficient use of the spectrum and good engineering practice.

(b) The maximum authorized bandwidth per 27.5 to 28.35 GHz frequency band is 850 MHz

8.4.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	May 26, 2020

8.4.3 Observations, settings and special notes

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 results*

Frequency, MHz	99% OBW, MHz	Limit, MHz	Margin, MHz
28122.500	53.205	850.000	796.795
28171.500	53.205	850.000	796.795
28213.500	53.205	850.000	796.795

Table 8.4-2: *Emission Bandwidth results*

Frequency, MHz	26 dB BW, MHz
28122.500	59.615
28171.500	59.936
28213.500	59.935

Test data, continued

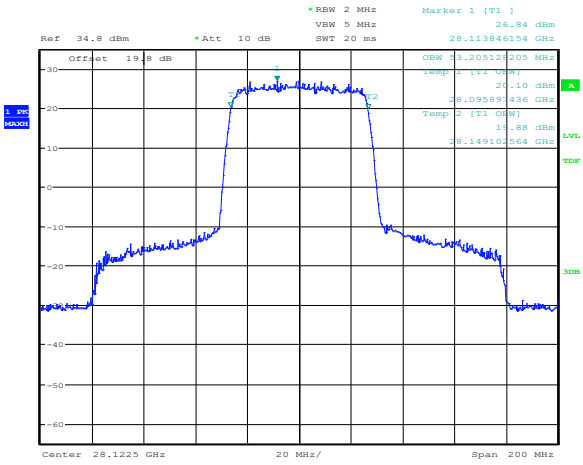


Figure 8.4-1: *99% OBW on low channel*

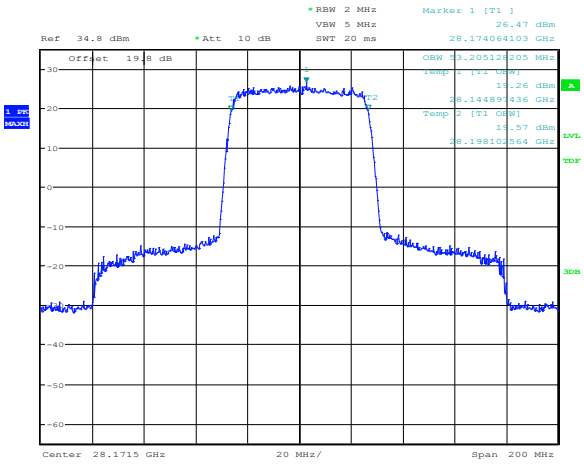


Figure 8.4-2: *99% OBW on mid channel*

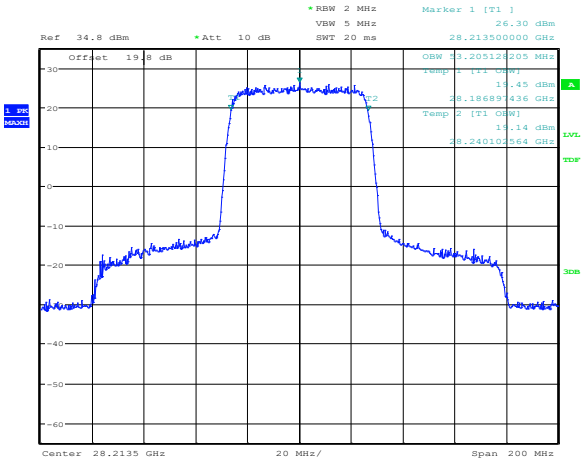


Figure 8.4-3: *99% OBW on high channel*

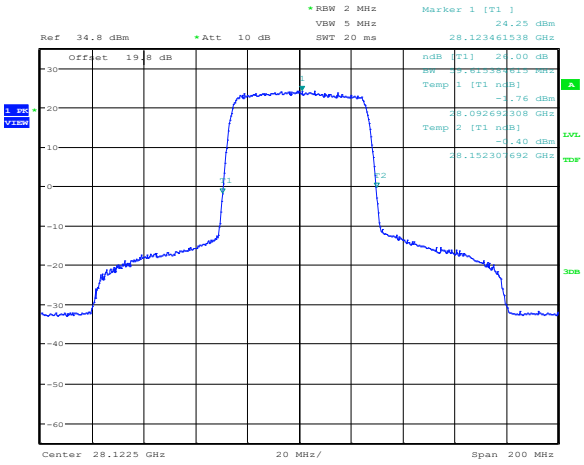


Figure 8.4-4: *26 dB BW on low channel*

Test data, continued

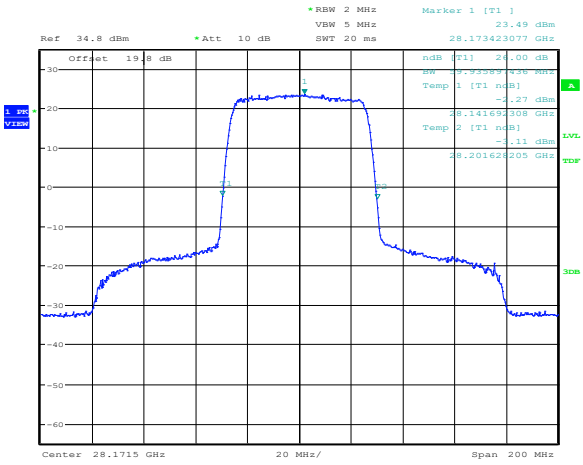


Figure 8.4-5: *26 dB BW on mid channel*

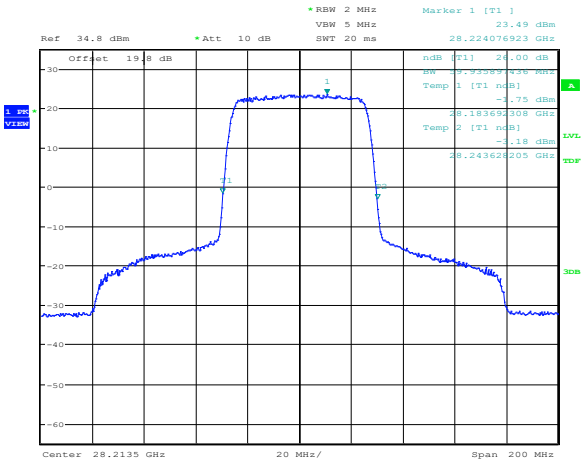


Figure 8.4-6: *26 dB BW on high channel*

8.5 Frequency stability

8.5.1 References, definitions and limits

FCC §30.402:

The carrier frequency of each transmitter authorized under this subpart must be maintained within the following percentage of the reference frequency (unless otherwise specified in the instrument of station authorization the reference frequency will be deemed to be the assigned frequency): 27.500 to 28.350 MHz band is 0.001%

8.5.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	May 28, 2020

8.5.3 Observations, settings and special notes

None

8.5.4 Test data

Table 8.5-1: *Frequency drift*

Test conditions	Frequency, Hz	Drift, %	Limit, ±%	Margin, %
+50 °C, Nominal voltage	28.171459795	0.000011132	0.001000000	-98.887
+40 °C, Nominal voltage	28.171458526	0.000006627	0.001000000	-99.337
+30 °C, Nominal voltage	28.171456514	-0.000000515	0.001000000	-99.949
+20 °C, Nominal voltage +15 %	28.171456603	-0.000000199	0.001000000	-99.980
+20 °C, Nominal voltage	28.171456659	*Reference*		
+20 °C, Nominal voltage −15 %	28.171456650	-0.000000032	0.001000000	-99.997
+10 °C, Nominal voltage	28.171457308	0.000002304	0.001000000	-99.770
0 °C, Nominal voltage	28.171459543	0.000010237	0.001000000	-98.976
−10 °C, Nominal voltage	28.171455306	-0.000004803	0.001000000	-99.520
−20 °C, Nominal voltage	28.171465159	0.000030172	0.001000000	-96.983

Notes: Drift percentage calculation:

$(F_M - F_R) / F_R \times 100\%$ where F_M is measured frequency, F_R is a reference frequency at 20 °C and nominal voltage.

Margin calculation:

$(\%_D - \%_L) / \%_L \times 100\%$ where $\%_D$ is a frequency drift percentage, $\%_L$ is a limit.

8.6 Modulation characteristics

8.6.1 References, definitions and limits

FCC §2.1047:

(d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

8.6.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	May 22, 2020

8.6.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth	1 MHz
Video bandwidth	> RBW
Detector	Peak, max-hold

8.6.4 Test data

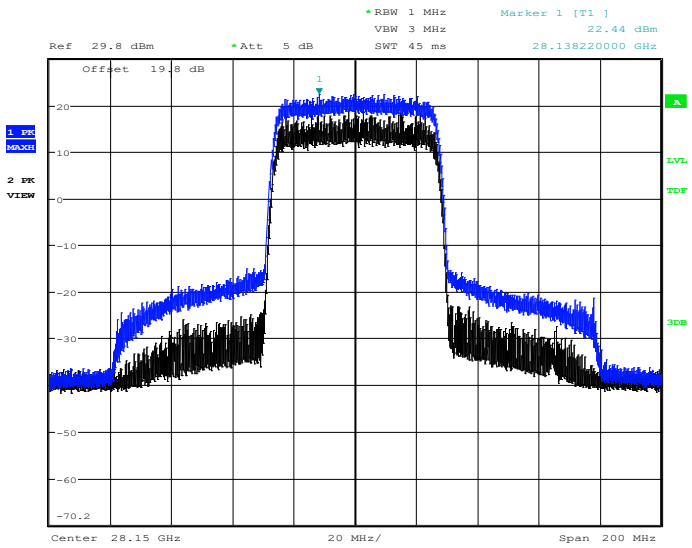
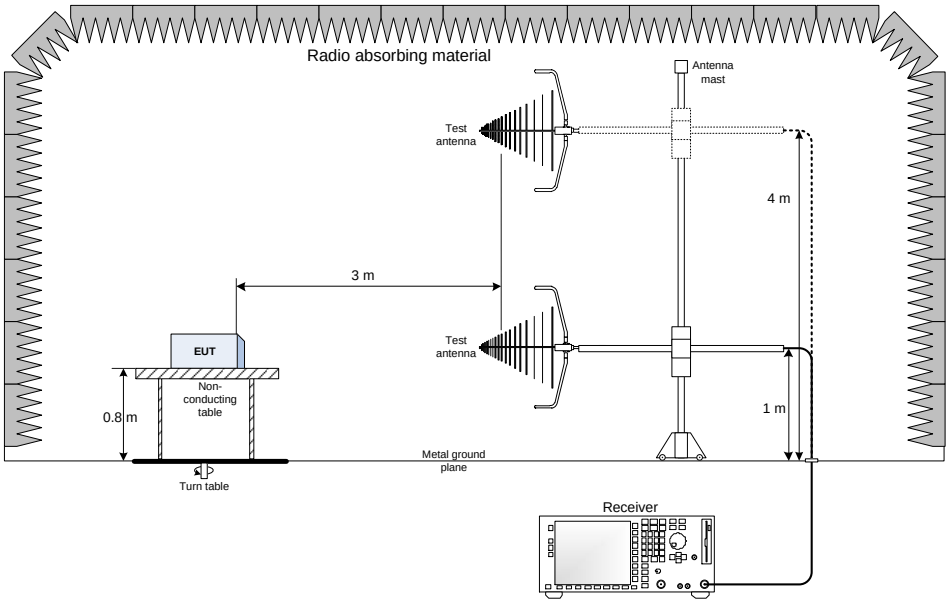


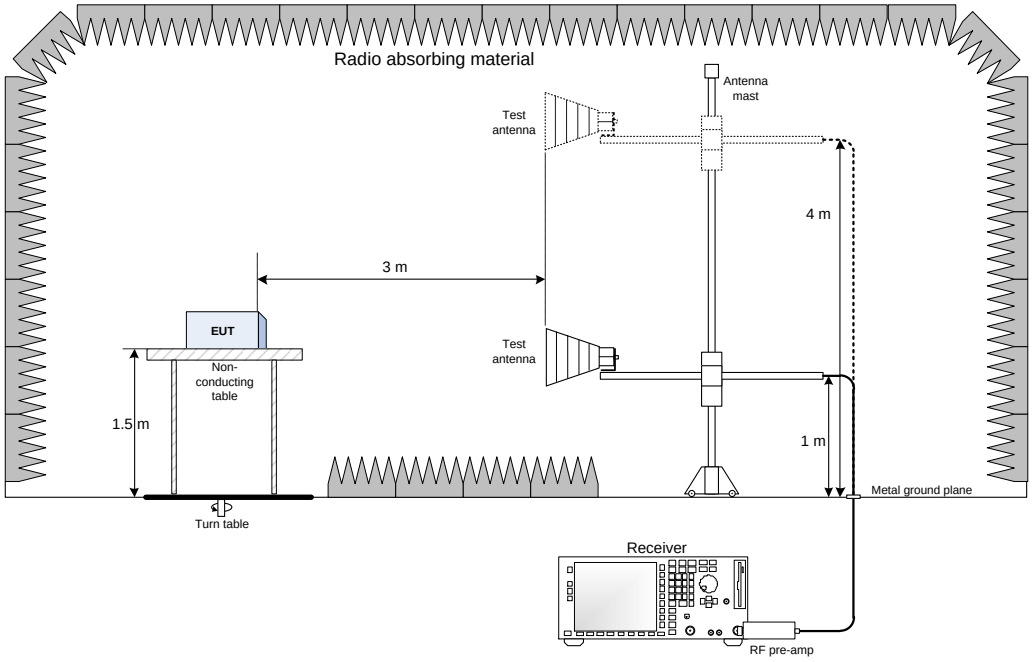
Figure 8.6-1: *Plot showing envelope of a digital modulation (Blue: 4QAM, Black: 256QAM)*

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 Antenna port set-up