Report Reference ID:	274225-1TRFWL

Test specification:	**Title 47 – Telecommunication** Chapter I – Federal Communication Commission Subchapter A – General Part 15 – Radio Frequency Devices Subpart C – Unintentional Radiators **§15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ.**

Applicant:	Meta System S.p.A. Via Galimberti, 5, – 42124- Reggio Emilia (RE) – Italy
Apparatus:	EOBD device
Model:	T.2
FCC ID:	P3O T2OBDBT

Testing laboratory:	**Nemko Italy Spa** Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221

	Name and title	**Date**
Tested by:	G. Curioni, Wireless/EMC Specialist	2015-05-22
Reviewed by:	P. Barbieri, Wireless/EMC Specialist	2015-05-22

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Section 1: Report summary

1.1 Test specification	
Specifications	**FCC Part 15 Subpart C, 15.247** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ.

1.2 Statement of compliance	
Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

1.3 Exclusions	
Exclusions	None

1.4 Registration number	
Test site FCC ID number	481407 (10 m Semi anechoic chamber) Due Date 10/2016.

1.5 Test report revision history	
Revision #	Details of changes made to test report
TRF	Original report issued

1.6 Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

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Section 2: Summary of test results

2.1 FCC Part 15 Subpart C – Intentional Radiators, test results

General requirements for FCC Part 15

Part	Test description	Verdict
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of operating frequencies	Pass
§15.203	Antenna requirement	N/A
§15.207(a)	Conducted limits	N/A
§15.215(c)	20 dB bandwidth	Pass

Specific requirements for FCC Part 15 Subpart C, 15.247

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	N/A
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	N/A
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	N/A
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	N/A
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	N/A
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(b)(4)	Maximum peak output power	N/A
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	N/A
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	N/A
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	N/A
§15.247(g)	Frequency hopping spread spectrum number of hopping channels	N/A
§15.247(h)	Coordination of frequency hopping systems other than FHSS	N/A
§15.247(i)	Radio frequency energy exposure	Pass

Notes: None

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details		
Applicant complete business name	Name:	Meta System S.p.A.
	Federal Registration Number (FRN):	0006537807
	Grantee code	P3O
Mailing address	Address: City: Province/State: Post code: Country:	Via Galimberti, 5 – 42124 Reggio Emilia (RE) – Italy Reggio Emilia (RE) – Italy 42124 Italy

3.2 Modular equipment	
a) Single modular approval	Single modular approval Yes ☒ No ☐
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details		
FCC ID	Grantee code:	P3O
	Product code:	T2OBDBT
Equipment class	DTS – Digital Transmission system	
Description of product as it is marketed	EOBD device	
	Model name/number:	T.2
	Serial number:	1/3

3.4 Application purpose	
Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

3.5 Composite/related equipment	
a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☐ No ☒
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☐ No ☒
c) Related FCC ID	If either of the above is “yes”: ☐ has been granted under the FCC ID(s) listed below: ☐ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: ii FCC ID:

3.6 Sample information	
Receipt date:	2015-01-09
Nemko sample ID number:	1/3

3.7 EUT technical specifications	
Operating band:	2400.0–2483.5 MHz
Operating frequency:	2404 MHz-2480 MHz (ch1-ch39)
Modulation type:	GFSK
Occupied bandwidth:	1.25 MHz
Channel spacing:	2 MHz
Emission designator:	1M25D7W
Antenna type:	Integral
Power source:	12 VDC car battery

3.8 Operation of the EUT during testing	
Details:	By Test Jig

3.9 EUT setup diagram

Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT	
Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures	
Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment	
Judgment	None

Section 5: Test conditions

5.1 Power source and ambient temperatures	
Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa 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.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6: Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements" and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Nemko Spa laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance 3m, 10m Chamber	Antenna distance 1m, 3m, 10m (30÷200) MHz	5.0 dB	(1)
	Antenna distance 1m, 3m, 10m (0.2÷6) GHz	5.2 dB	(1)
	Antenna distance 1m, 3m (6÷18) GHz	5.8 dB	(1)
	Antenna distance 1m, 3m (18÷40) GHz	7.2 dB	(1)
Conducted Disturbance	9 kHz ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	9 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Clicks	9 kHz ÷ 150 kHz	3.8 dB	(1)
	150 kHz ÷ 30 MHz	3.4 dB	(1)
Disturbance Power	30 MHz ÷300 MHz	4.5 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2%	(1)
	1kHz ÷ 40GHz	10-6	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	2%	(1)
Voltage Fluctuation Emission	--	2%	(1)
	Time	10%	
EMF	Lighting Equipment	26%	(1)
	Other Equipment	20%	

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2 which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %;
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Spectrum analyser	Rohde & Schwarz	FSEK	848 255/005	08-2015
EMI Test Receiver	Rohde & Schwarz	ESU8	100202	04-2016
Trilog antenna 25-8000 MHz	Schwarzbeck	VULB 9162	9162-025	05-2018
Bilog antenna 1-18 GHz	Schwarzbeck	STLP 9148	STLP 9148-123	05-2018
Preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	BBV 9718-137	10-2015
Double ridge waveguide Horn antenna 4.40 GHz	RF spin	DRH40	061106A40	08-2016
Preamplifier 4-40 GHz	Miteq	JS44	1648665+ 1648789	11-2015
--	--	--	--	--

Note: N/A = Not applicable, NCR = No cal required, COU = Cal on use

Section 8: Testing data

8.1 Clause 15.31(e) Variation of power source

§ 15.31 Measurement standards.

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Special notes

None

Test data

No change of power, the device contains a stabilized power supply.

8.2 Clause 15.31(m) Number of operating frequencies

§ 15.31 Measurement standards.

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Special notes

None

Test data

The frequency band is 2400.0-2483.5MHz therefore number of operating frequencies is 3

Low frequency / channel 1	2404 MHz
Mid frequency / channel 20	2442 MHz
High frequency / channel 39	2480 MHz

8.3 Clause 15.203 Antenna requirement

§ 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Special notes

None

Test data

INTEGRAL ANENNA (NO RF CONNECTOR)

8.4 Clause 15.207(a) Conducted limits

§ 15.207 Conducted limits.

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

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

*-Decreases with the logarithm of the frequency.

Special notes

None

Test data

The device is not equipped with power cords, is provided on integrated OBD connector and it is fed by the car battery 12 Vdc.

8.5 Clause 15.215(c) Emission bandwidth

§ 15.215 Additional provisions to the general radiated emission limitations

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

Special notes

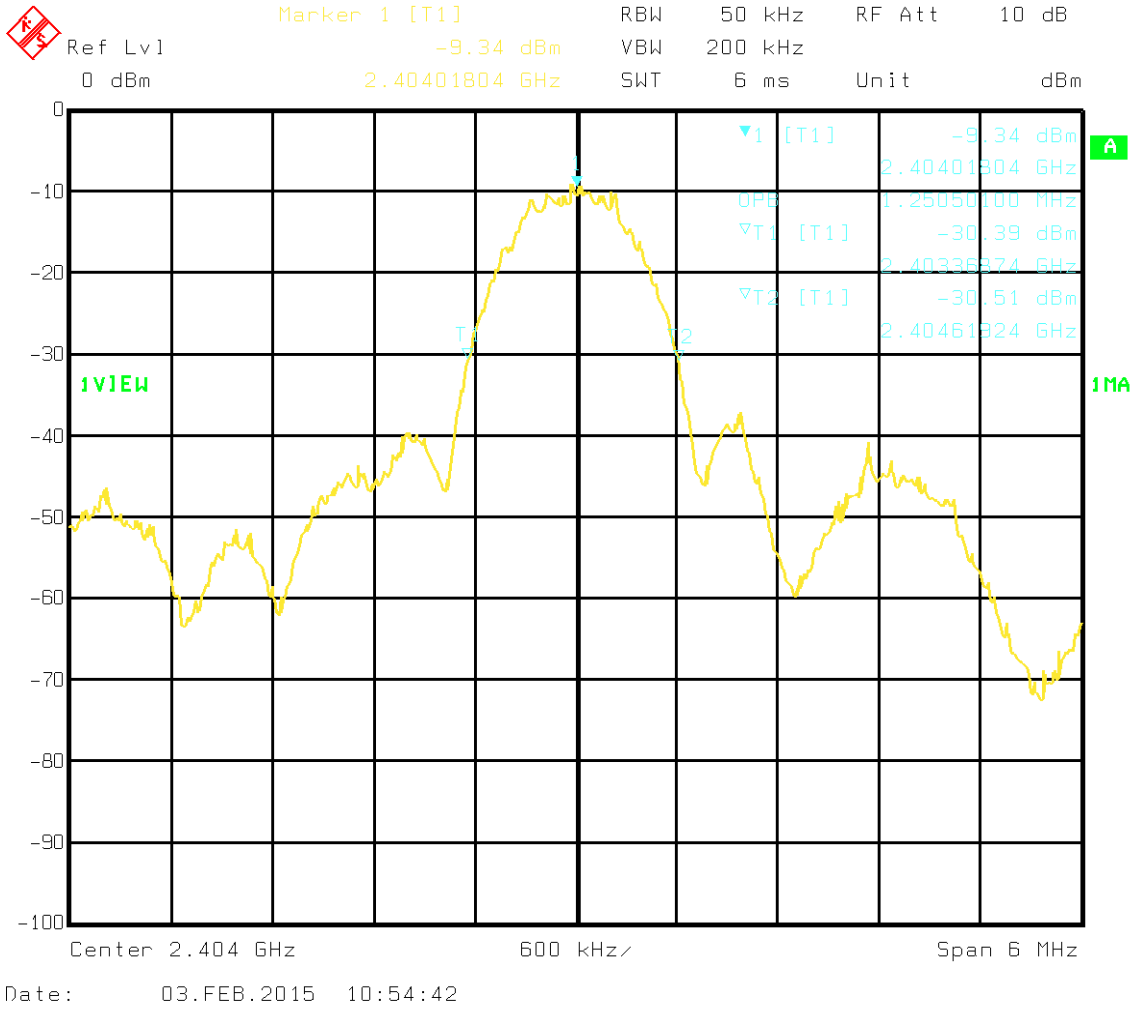
The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

Low channel



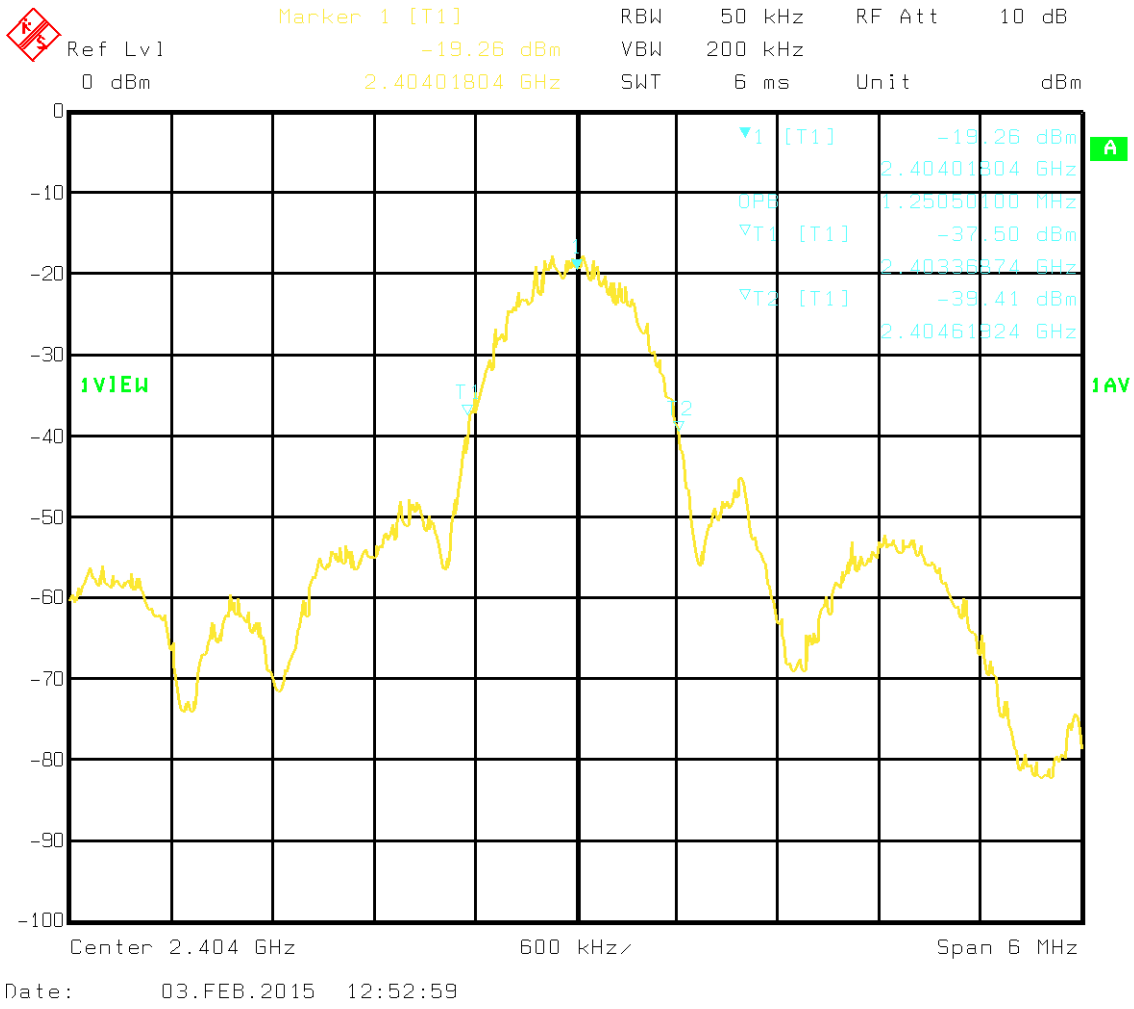
PEAK

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

Low channel



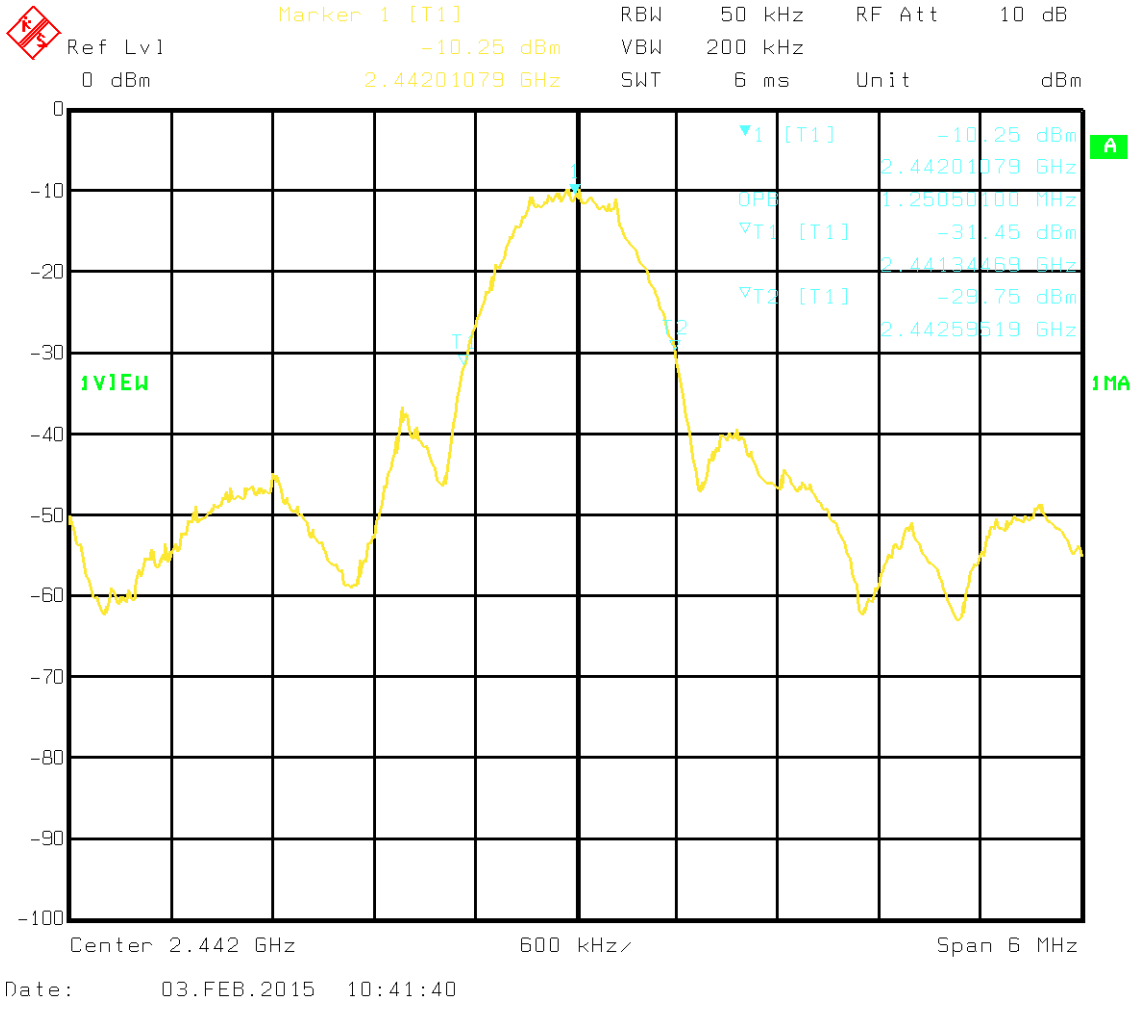
AVERAGE

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

Mid channel



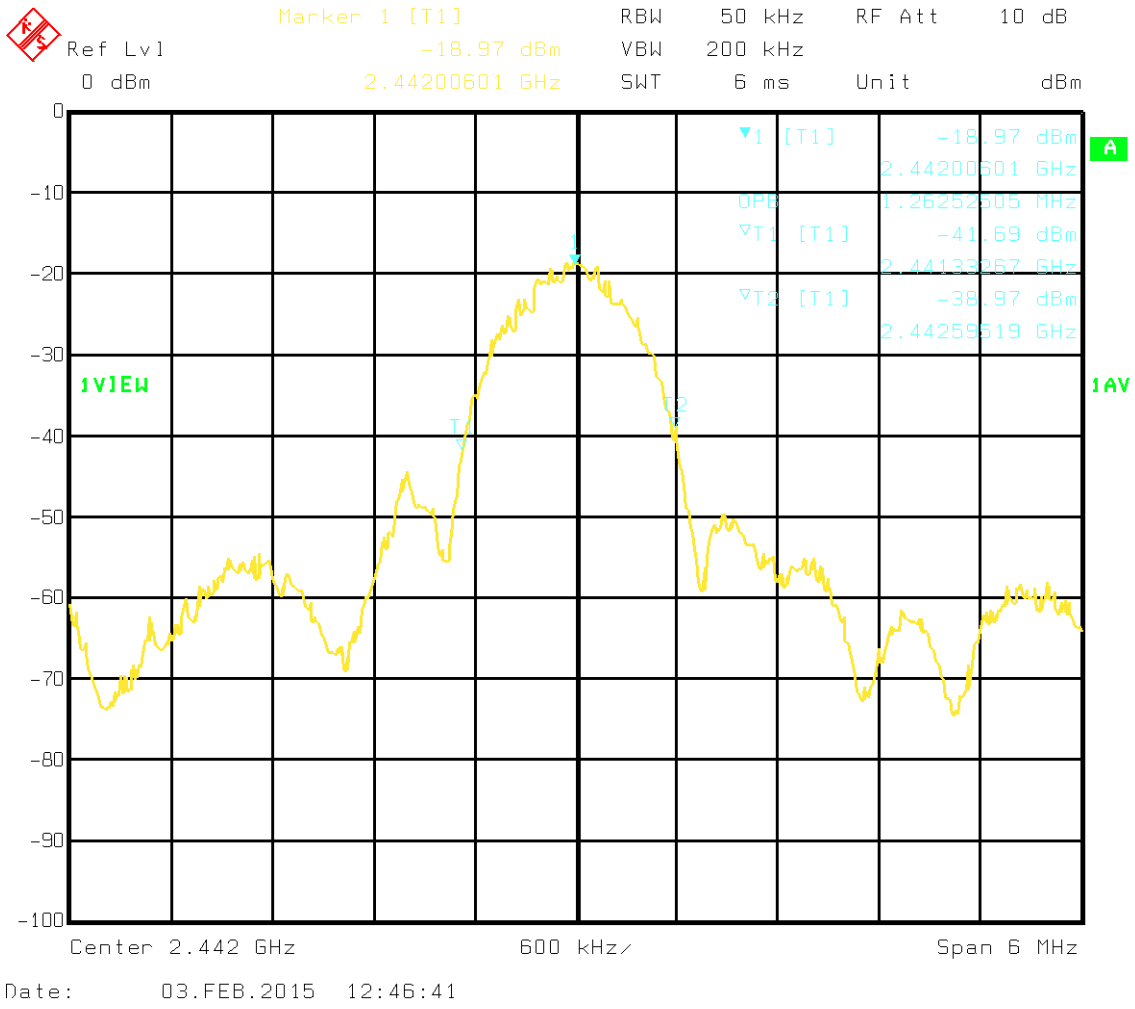
PEAK

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

Mid channel



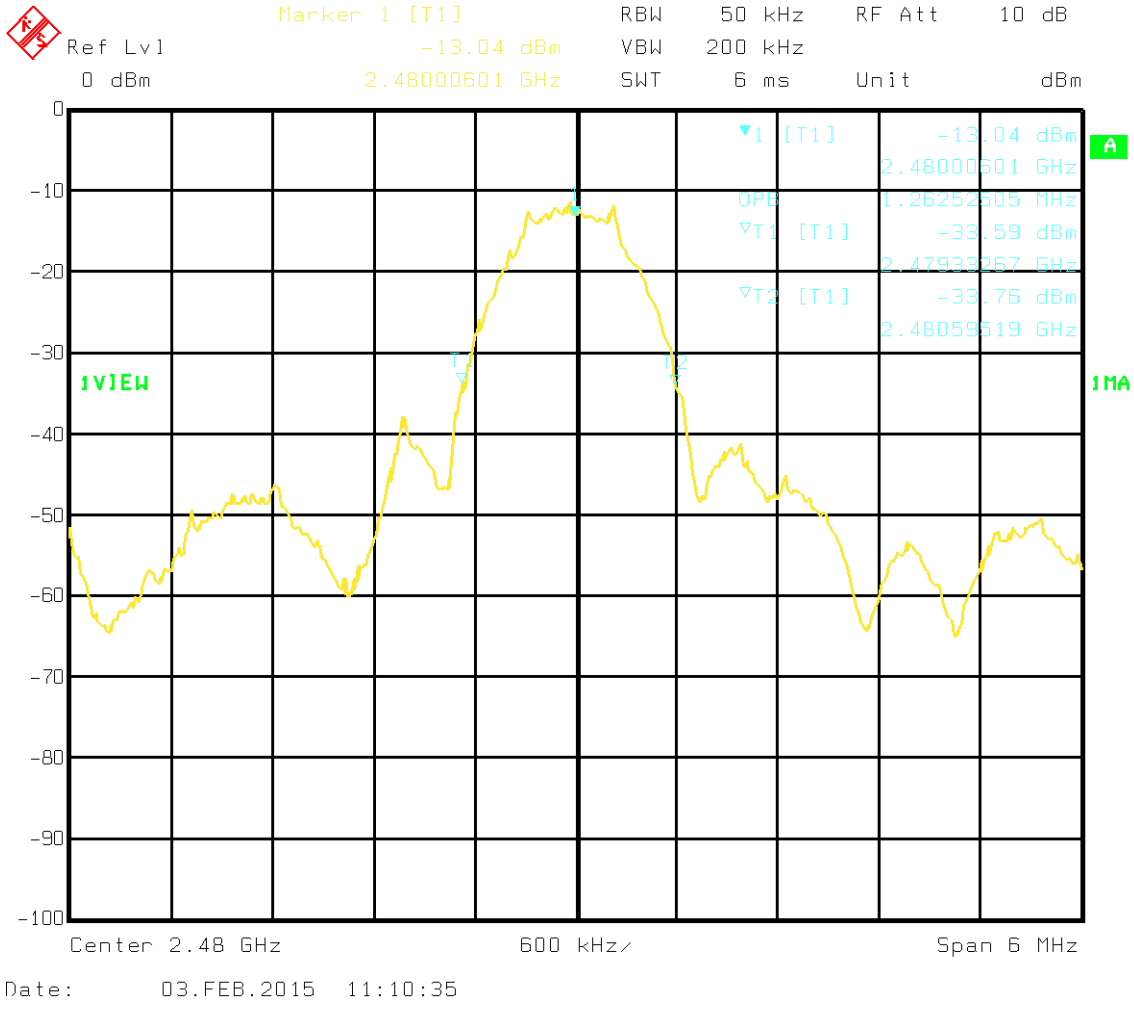
AVERAGE

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

High channel



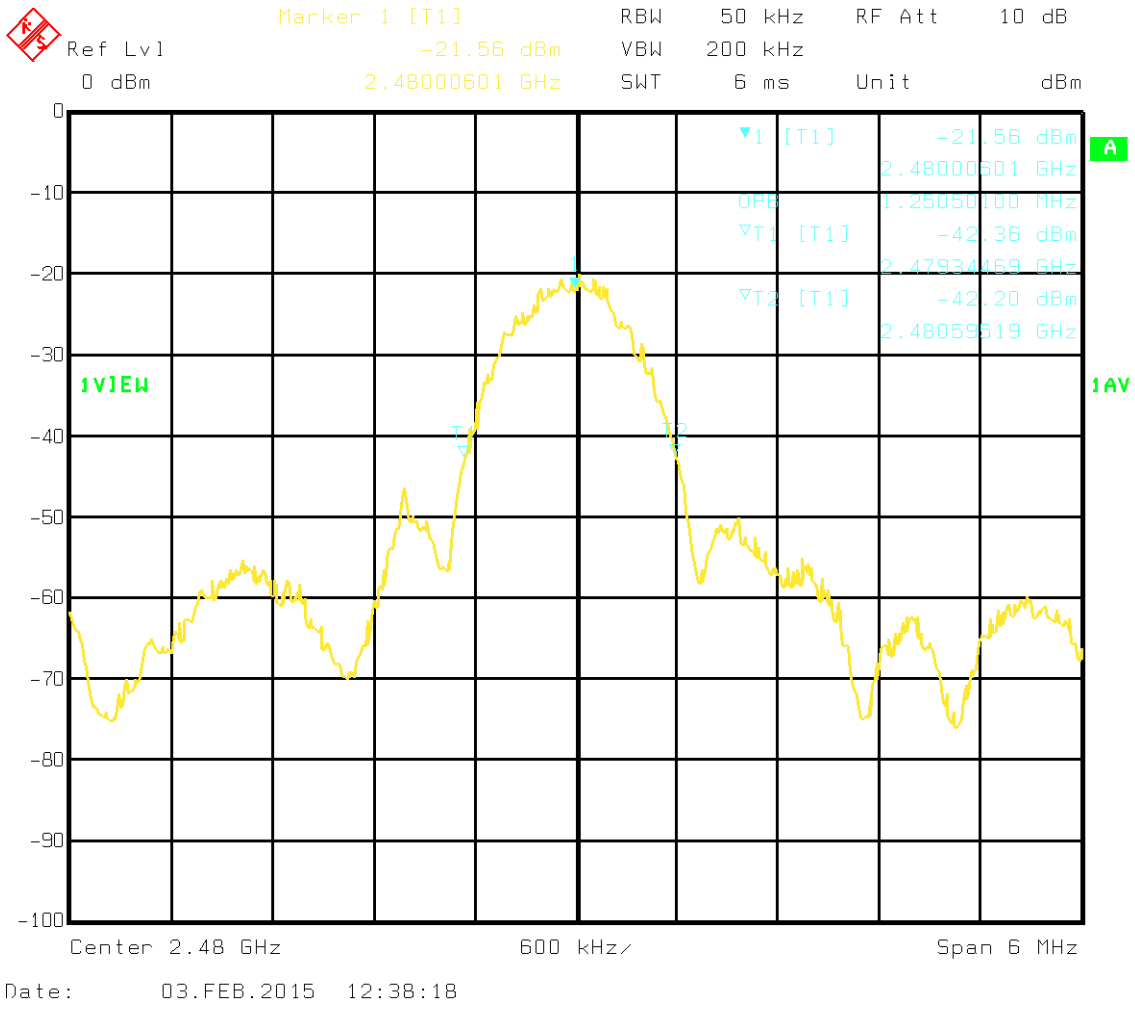
PEAK

Test Name: Clause 15.215(c) Emission bandwidth
Test date: 2015-02-03 **Verdict::** Pass
Test engineer: G. Curioni

Specification: FCC Part 15 Subpart C

Test data

Hig channel



AVERAGE

Test Name: Clause 15.247(a)(2) Min. 6 dB bandwidth for systems using DMT
Test date: 2015-05-22 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

8.6 Clause 15.247(a)(2) Min. 6 dB bandwidth for systems using DMT

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ.

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

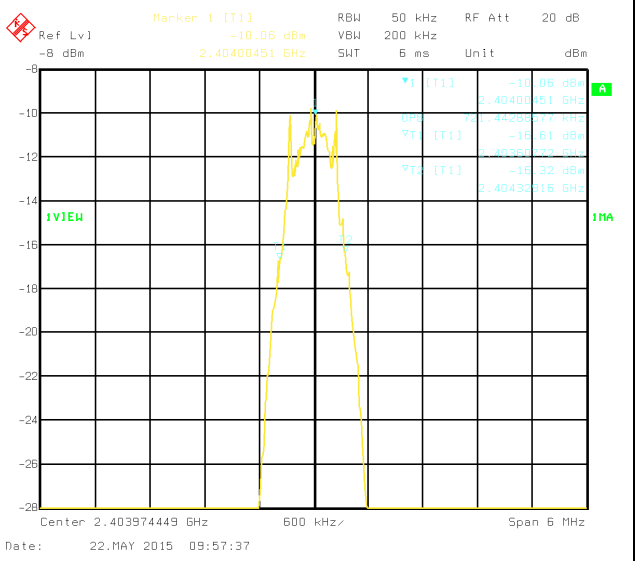
(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz:

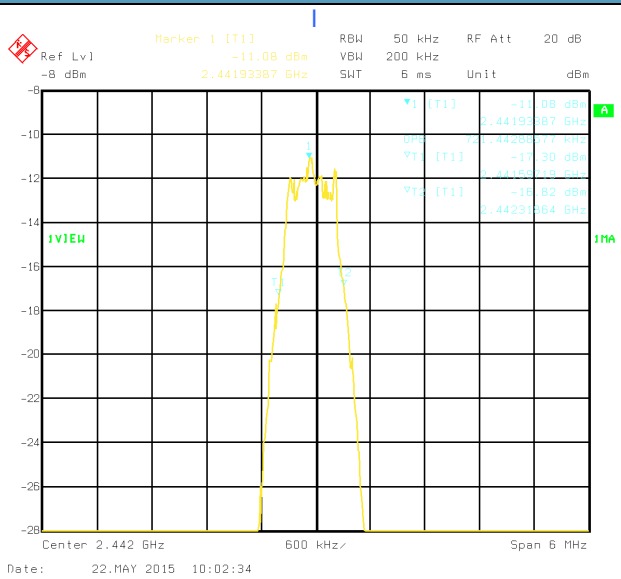
Special notes

None

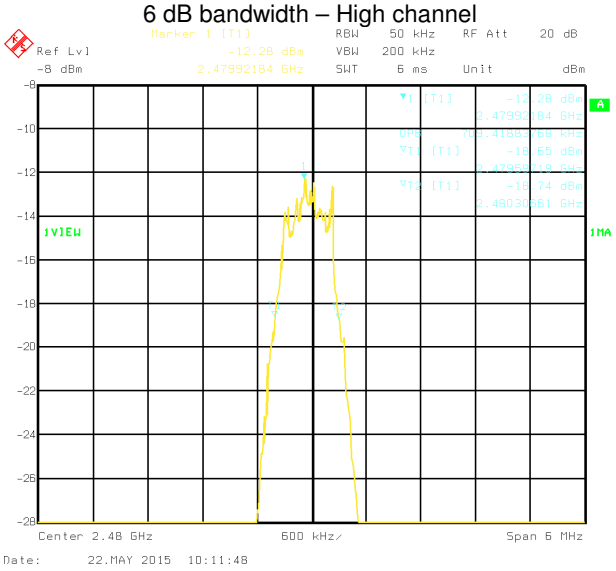
Test Name: Clause 15.247(a)(2) Min. 6 dB bandwidth for systems using DMT
Test date: 2015-05-22 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data





6 dB bandwidth – High channel



Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
2404	0.721	> 0.5	0.221
2442	0.721	> 0.5	0.221
2480	0.709	> 0.5	0.209

– The peak detector was used with 50 kHz/0.2 MHz RBW/VBW
– The span was wider than RBW.

Results

Refer to spectral plots and tables of this section.

Test Name: Clause 15.247(b)(3) Maximum peak conducted output power
Test date: 2015-05-22 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

8.7 Clause 15.247(b)(3) Maximum peak conducted output power

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(e) Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Special notes

None

Test Name: Clause 15.247(b)(3) Maximum peak conducted output power
Test date: 2015-05-22 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data

Conducted output power:

Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Margin (dB)
2404	-7.27	30.0	37.27
2442	-8.38	30.0	38.38
2480	-9.44	30.0	39.44

EIRP calculation:

Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2404	-8.86	36.0	44.86
2442	-9.97	36.0	45.97
2480	-11.03	36.0	47.03

EIRP = Conducted output power [dBm] + antenna gain [dBi]
Antenna gain = -1,59 dBi

Maximum output power = -7.27 dBm Limit = 30 dBm
Maximum EIRP = -8.86 dBm Limit = 36 dBm

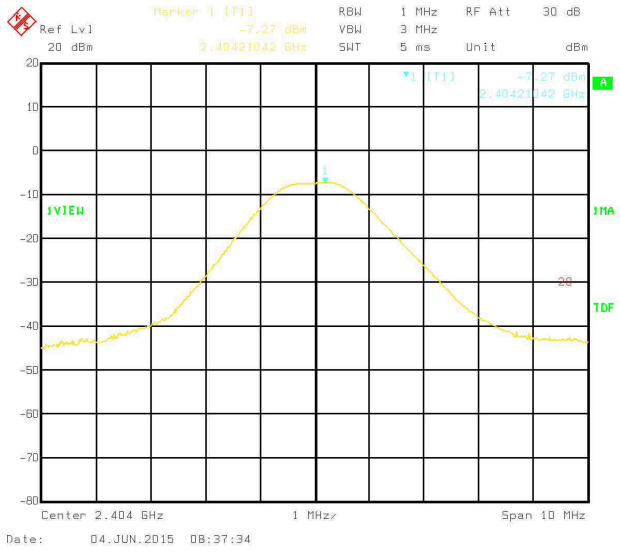
- The peak detector was used with RBW wider that 20 dB bandwidth.
- The span was wider than RBW.

Test Name: Clause 15.247(b)(3) Maximum peak conducted output power
Test date: 2015-05-22 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

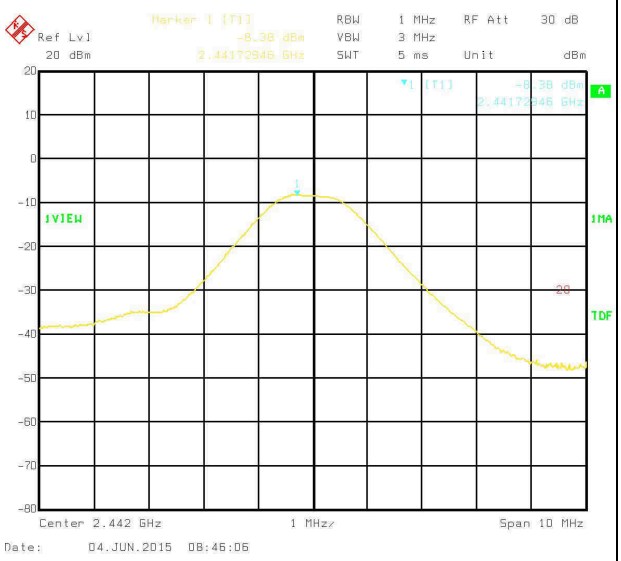
Test data continued

Conducted spectral plots: EUT arrangement normal use

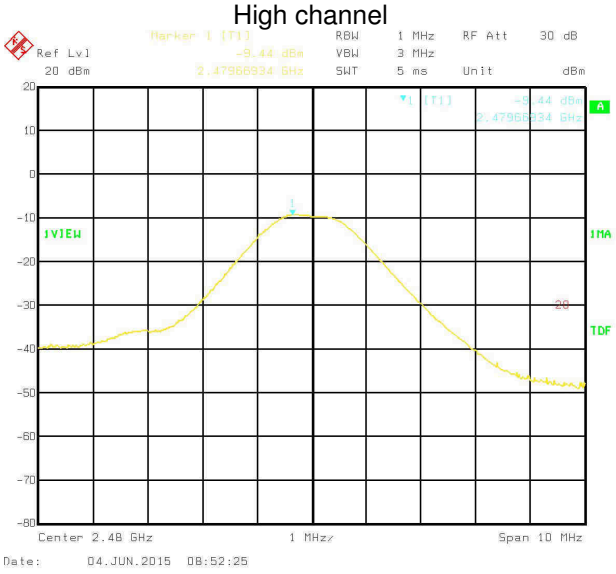
Low channel



Mid channel



High channel



8.8 Clause 15.247(d) Spurious emissions

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Special notes

§15.209 – Radiated emission limits

Frequency (MHz)	Field strength		Measurement distance (m)
	(µV/m)	(dBµV/m)	
0.009–0.490	2400/F	67.6–20log(F)	300
0.490–1.705	24000/F	87.6–20log(F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes:
- F = fundamental frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

§15.205 – Restricted bands of operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
  - below 30 MHz: using a quasi-peak detector with 9 kHz/30 kHz RBW/VBW,
  - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
  - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
    - and using peak detector with 1 MHz/10 Hz RBW/VBW for average results
    - or using average detector with 1 MHz/3 MHz RBW/VBW for average results
    - or using a duty cycle/average factor for average results calculations.

Test data

Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

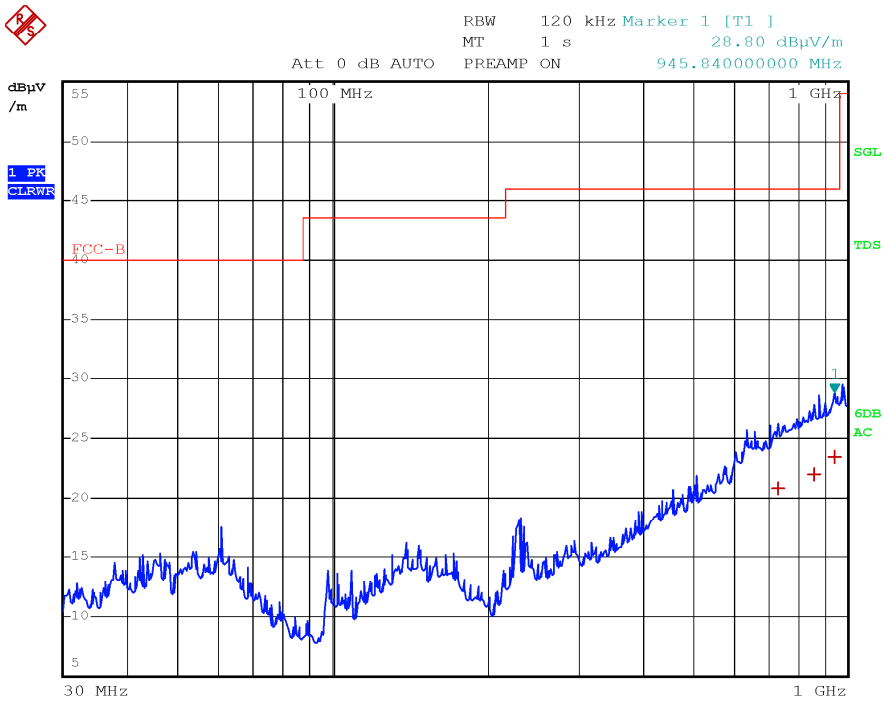
Duty cycle/average factor calculations:

$$Duty\,cycle/average\,factor = 20\times\log_{10}\left(\frac{Tx_{100\,ms}}{100\,ms}\right)$$

NO DUTY CYCLE

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch1 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

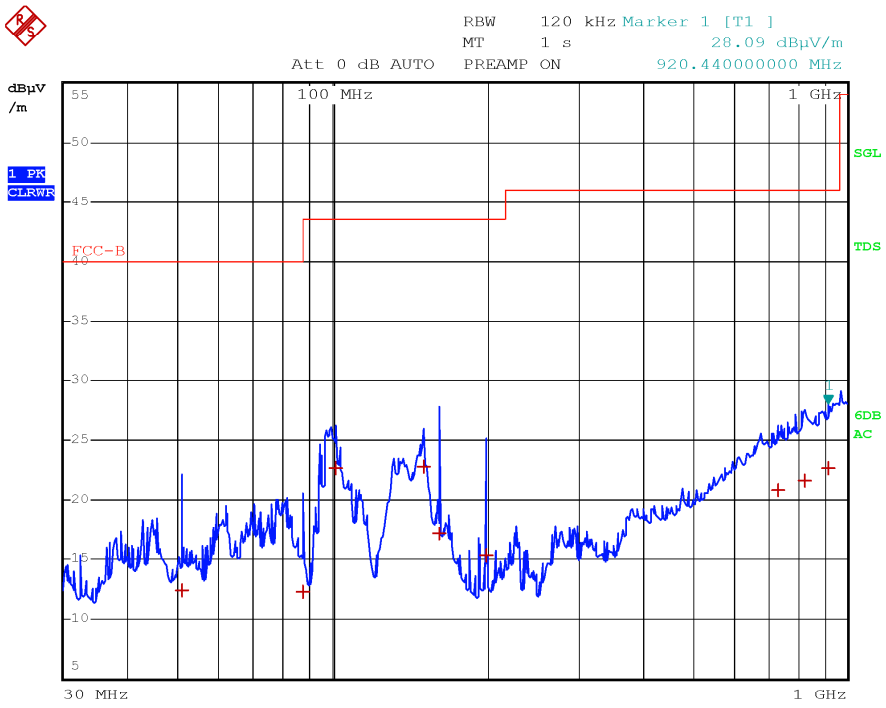
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	735.84 MHz	20.75	-25.24
1 Quasi Peak	863.24 MHz	21.96	-24.03
1 Quasi Peak	945.84 MHz	23.37	-22.62

Date: 29.JAN.2015 08:10:52

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 1 pol V

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

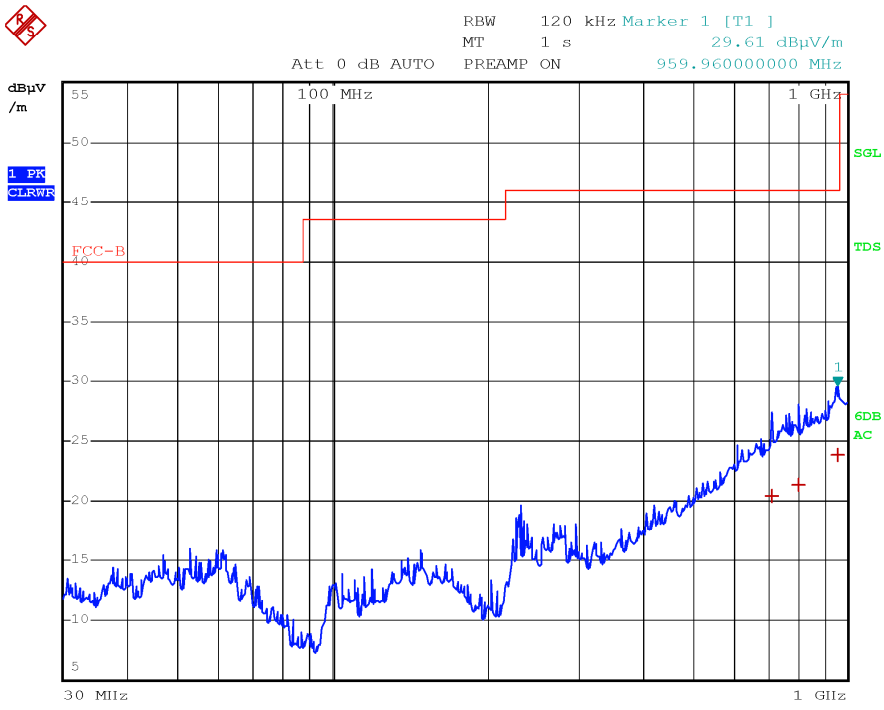
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	51 MHz	12.37	-27.62
1 Quasi Peak	87.52 MHz	12.24	-27.75
1 Quasi Peak	101.76 MHz	22.58	-20.91
1 Quasi Peak	150.68 MHz	22.77	-20.72
1 Quasi Peak	161.76 MHz	17.11	-26.38
1 Quasi Peak	199.28 MHz	15.35	-28.14
1 Quasi Peak	733.4 MHz	20.78	-25.21
1 Quasi Peak	826.28 MHz	21.64	-24.35
1 Quasi Peak	920.44 MHz	22.59	-23.40

Date: 29.JAN.2015 08:06:46

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 20 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

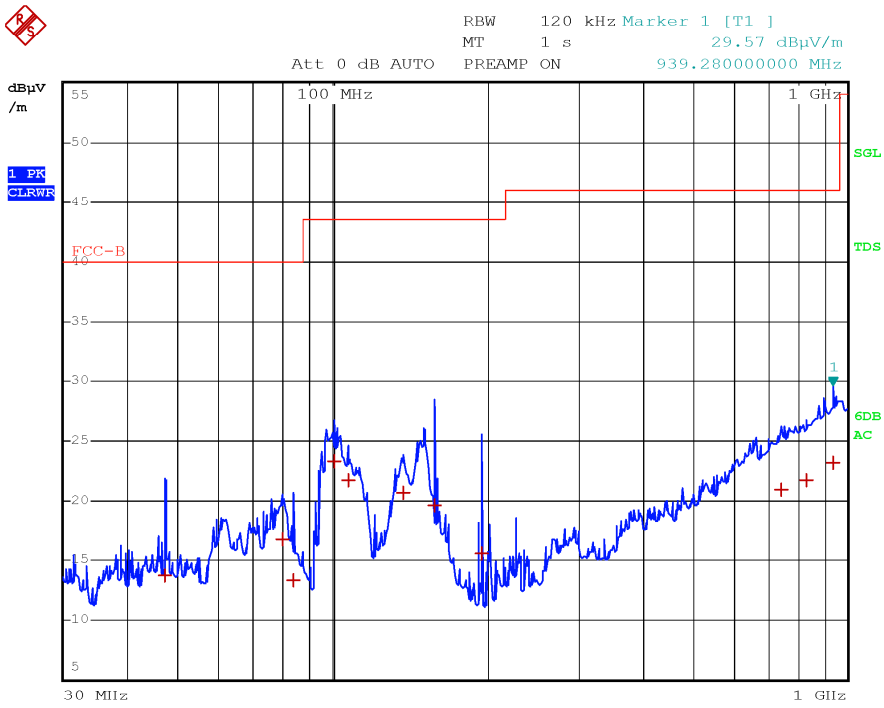
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	715.4 MHz	20.38	-25.61
1 Quasi Peak	806.36 MHz	21.39	-24.60
1 Quasi Peak	959.96 MHz	23.77	-22.22

Date: 29.JAN.2015 08:19:01

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 20 pol V

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

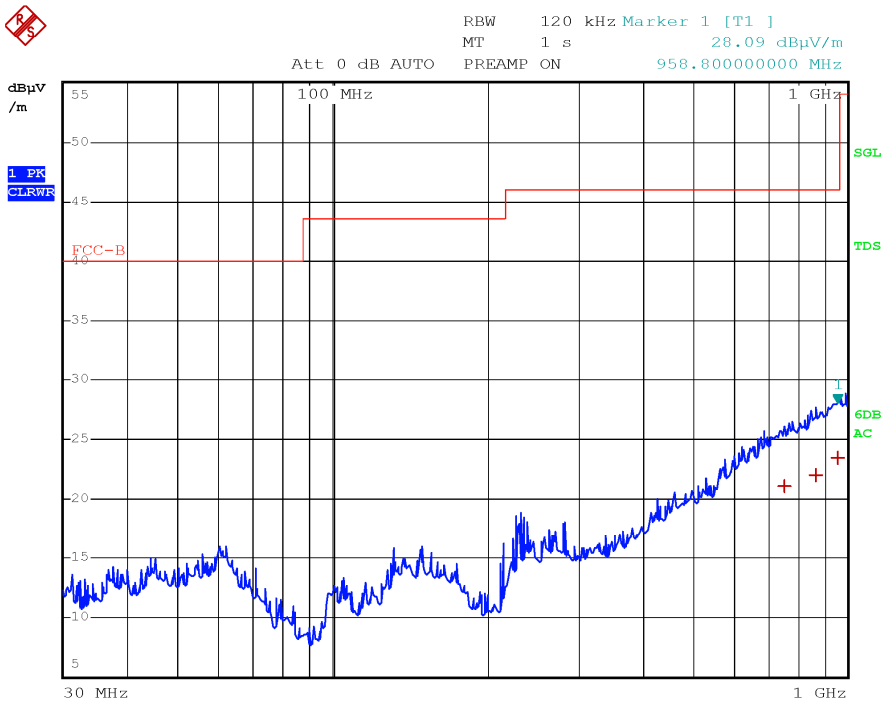
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	47.44 MHz	13.75	-26.24
1 Quasi Peak	79.96 MHz	16.70	-23.21
1 Quasi Peak	83.88 MHz	13.32	-26.67
1 Quasi Peak	100.8 MHz	23.26	-20.23
1 Quasi Peak	107.32 MHz	21.70	-21.79
1 Quasi Peak	137.8 MHz	20.66	-22.83
1 Quasi Peak	158.12 MHz	19.69	-23.80
1 Quasi Peak	195.6 MHz	15.60	-27.89
1 Quasi Peak	745.68 MHz	20.95	-25.04
1 Quasi Peak	834.88 MHz	21.76	-24.23
1 Quasi Peak	939.28 MHz	23.17	-22.82

Date: 29.JAN.2015 08:21:51

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 39 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

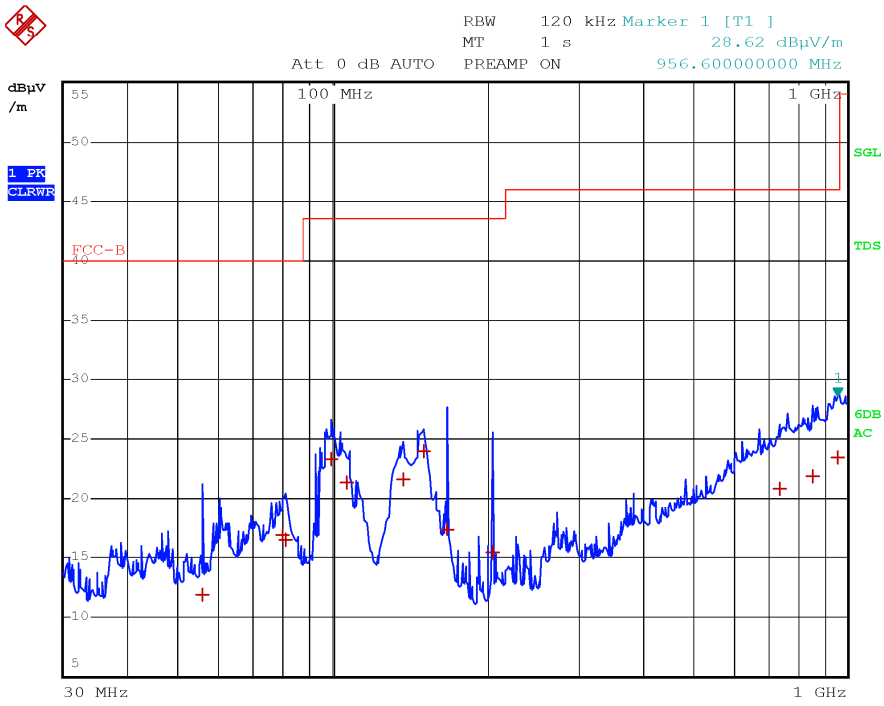
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	755.04 MHz	21.10	-24.89
1 Quasi Peak	868.8 MHz	21.94	-24.05
1 Quasi Peak	958.8 MHz	23.43	-22.56

Date: 29.JAN.2015 08:31:44

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 39 pol V

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued

EDIT PEAK LIST (Final Measurement Results)

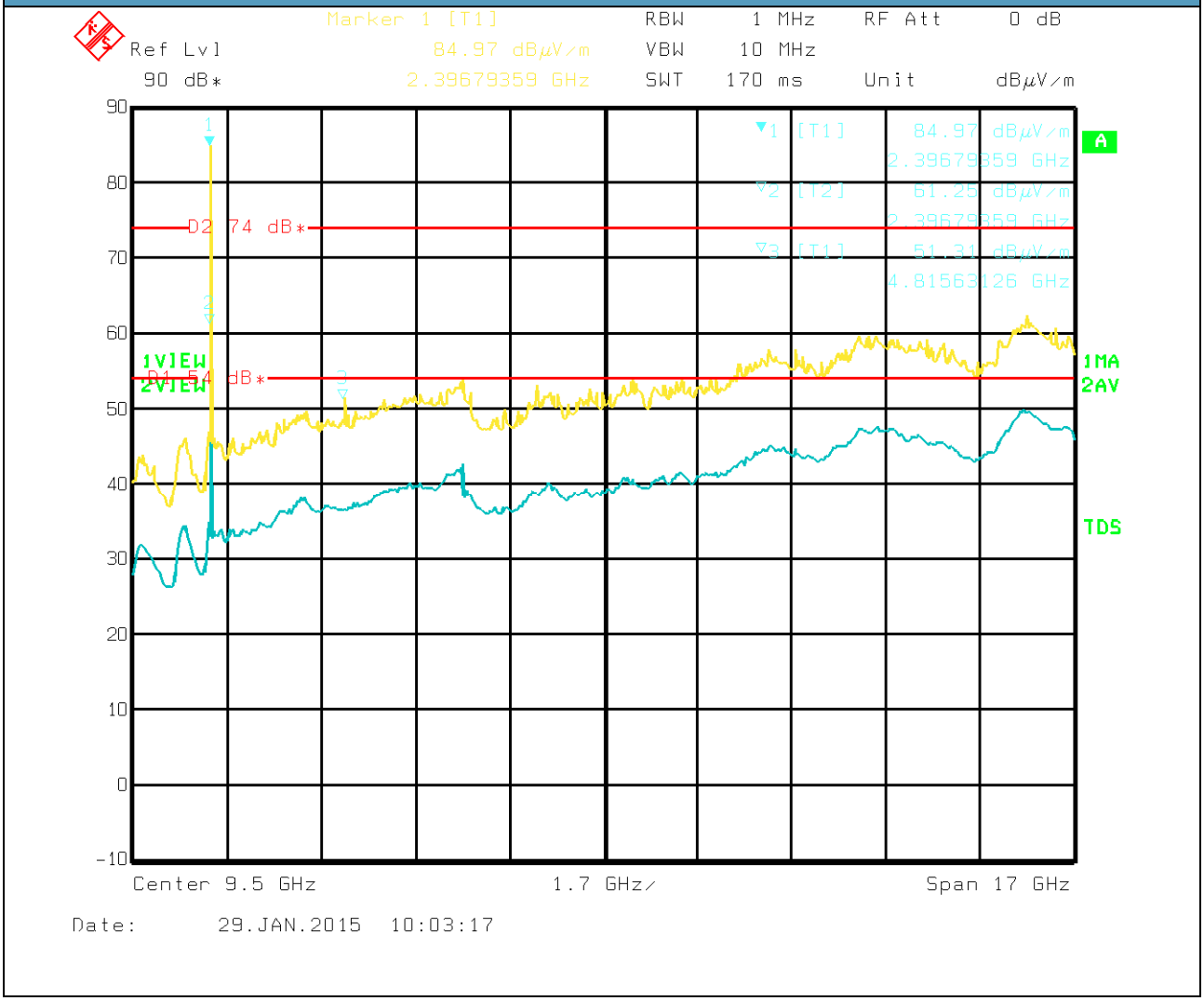
Trace1:	FCC-B
Trace2:	---
Trace3:	---

TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	56.04 MHz	11.83	-28.16
1 Quasi Peak	79.92 MHz	16.86	-23.13
1 Quasi Peak	81.4 MHz	16.45	-23.54
1 Quasi Peak	99.36 MHz	23.31	-20.18
1 Quasi Peak	106.36 MHz	21.40	-22.09
1 Quasi Peak	137.8 MHz	21.54	-21.95
1 Quasi Peak	150.72 MHz	23.90	-19.59
1 Quasi Peak	166.96 MHz	17.36	-26.13
1 Quasi Peak	204.32 MHz	15.42	-28.07
1 Quasi Peak	738.16 MHz	20.83	-25.17
1 Quasi Peak	854.96 MHz	21.90	-24.09
1 Quasi Peak	956.6 MHz	23.41	-22.58

Date: 29.JAN.2015 08:27:58

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

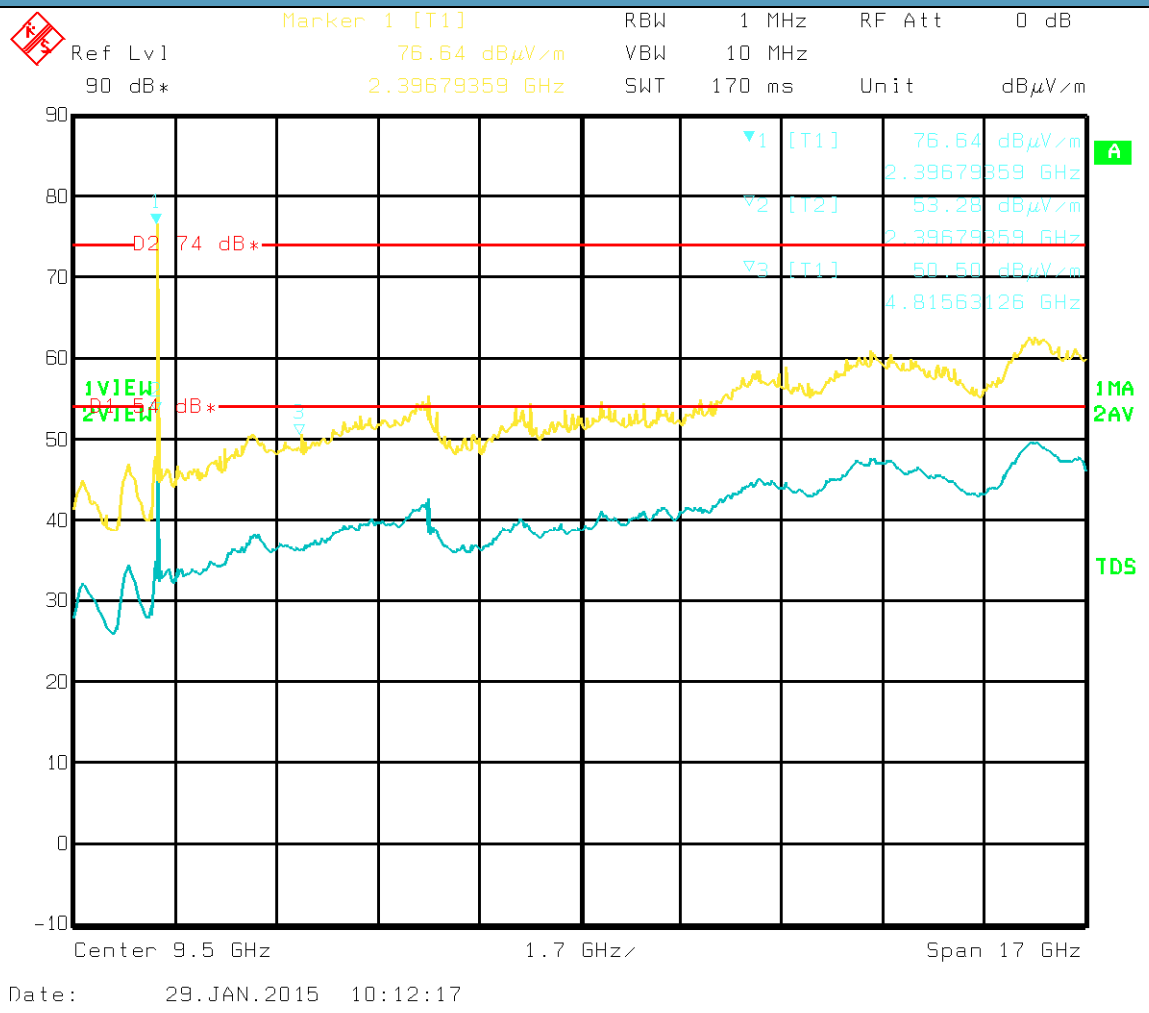
Test data, continued



Ch 1 pol H, 1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

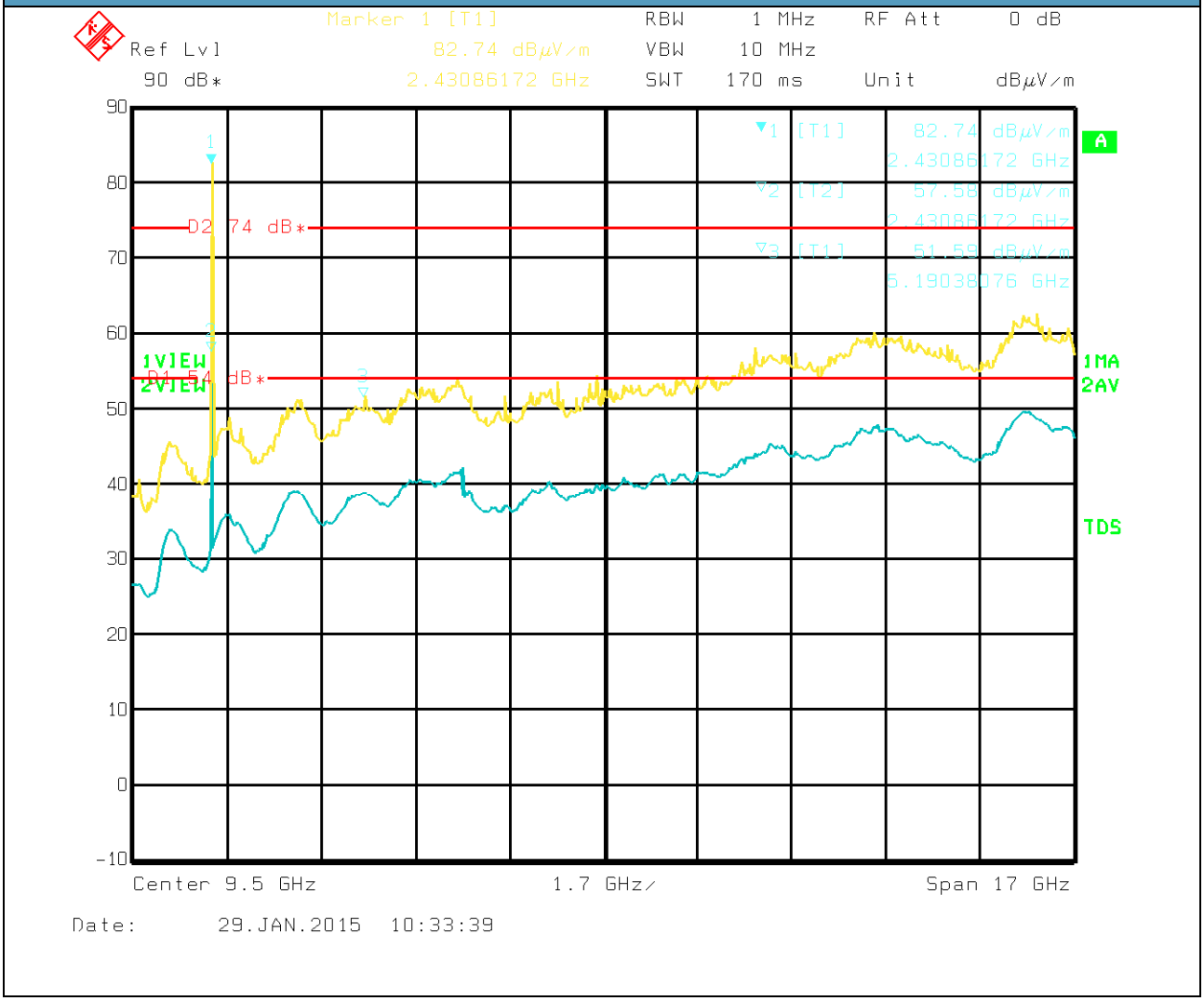
Test data, continued



Ch 1 pol V, 1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

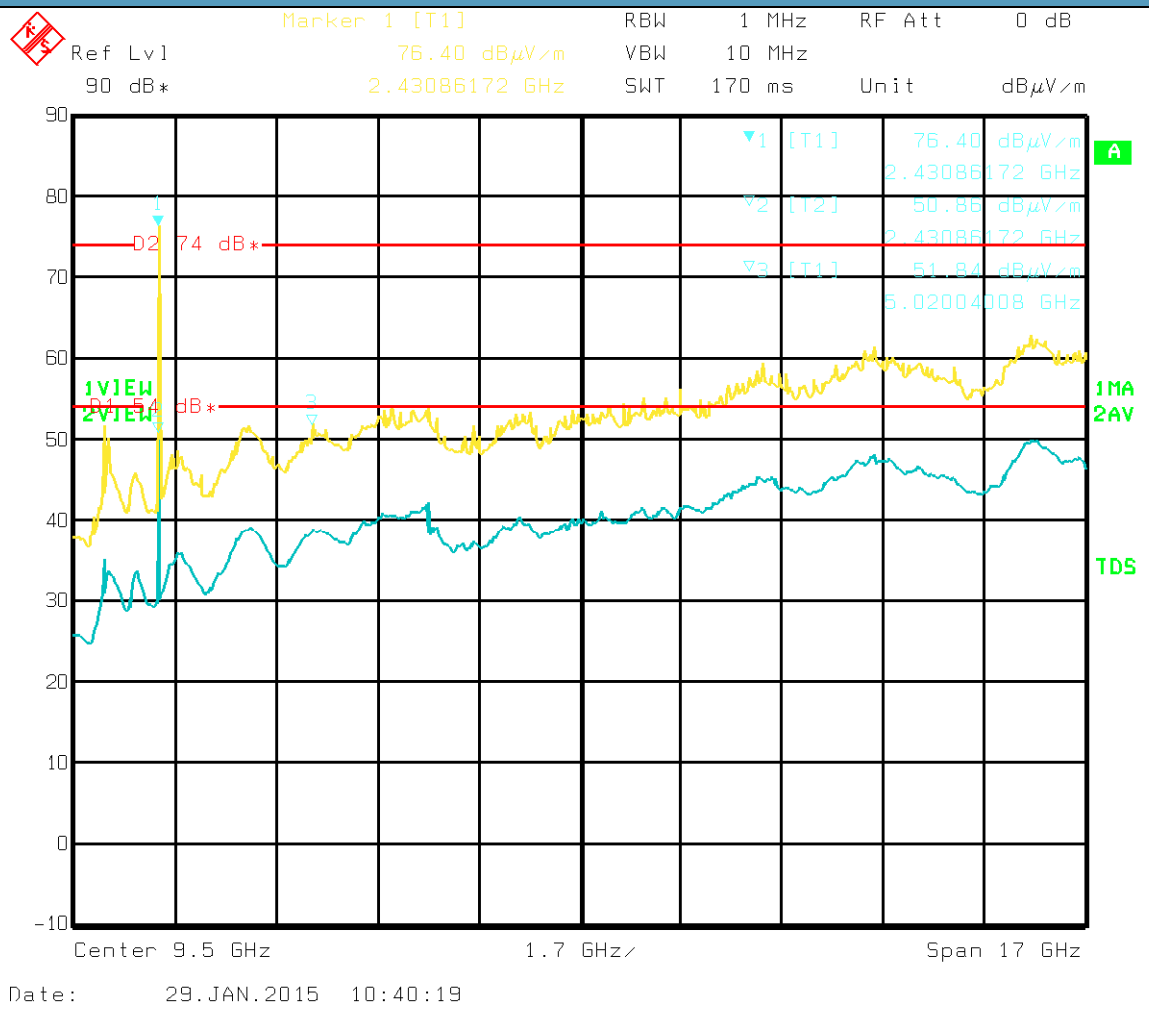
Test data, continued



Ch 20 pol H, 1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

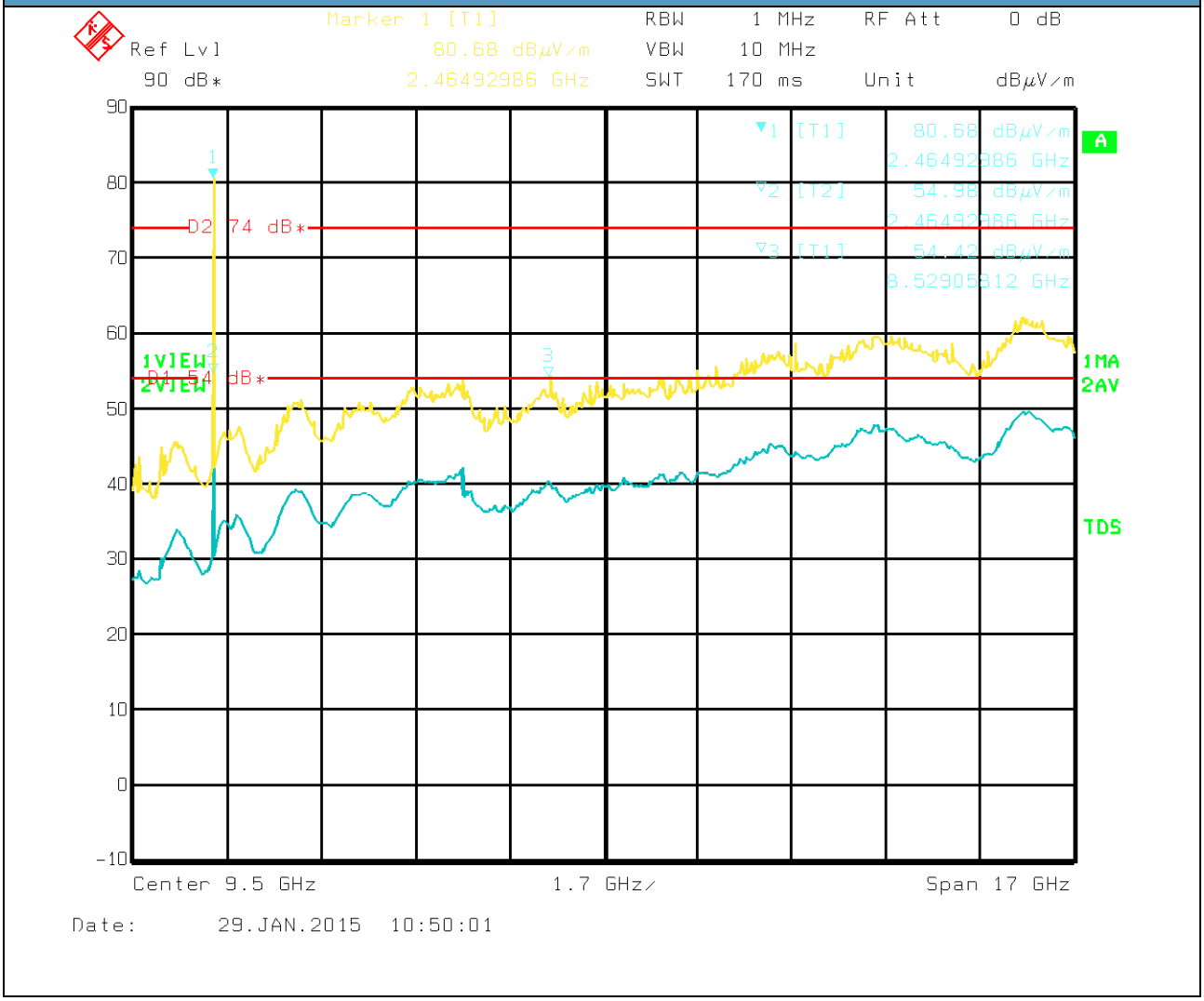
Test data, continued



Ch 20 pol V, 1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

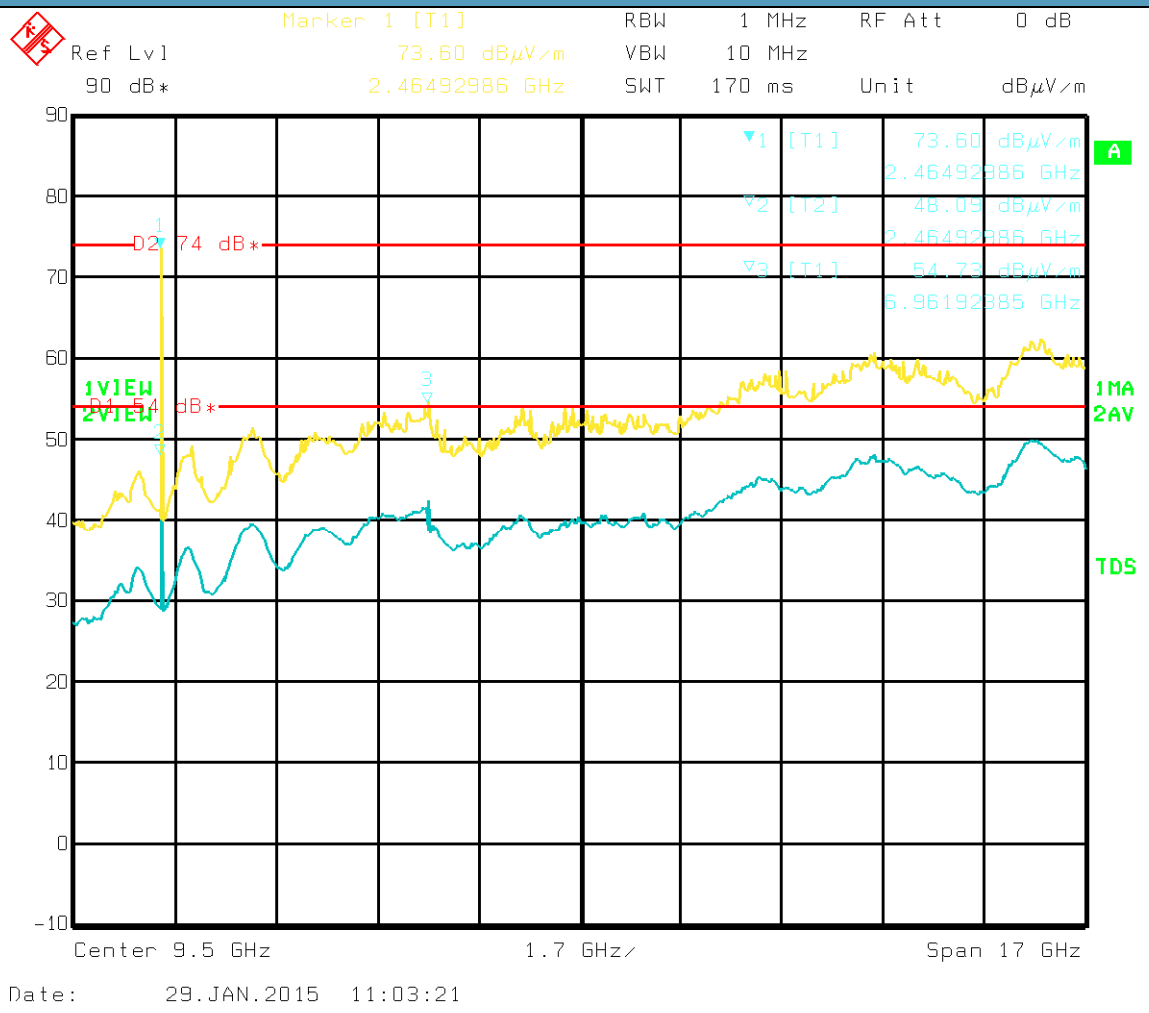
Test data, continued



Ch 39 pol H,1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

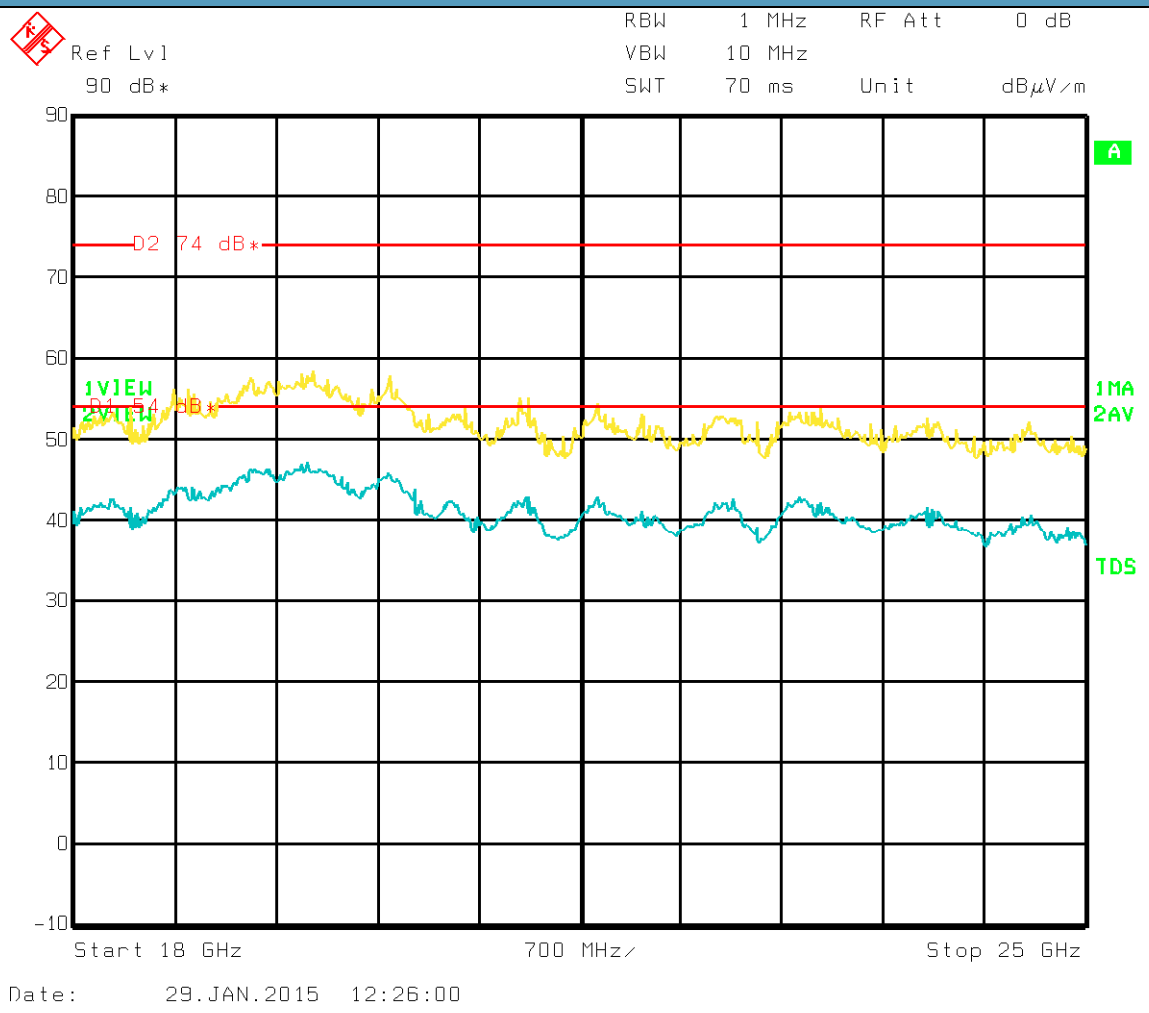
Test data, continued



Ch 39 pol V, 1-18 GHz

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

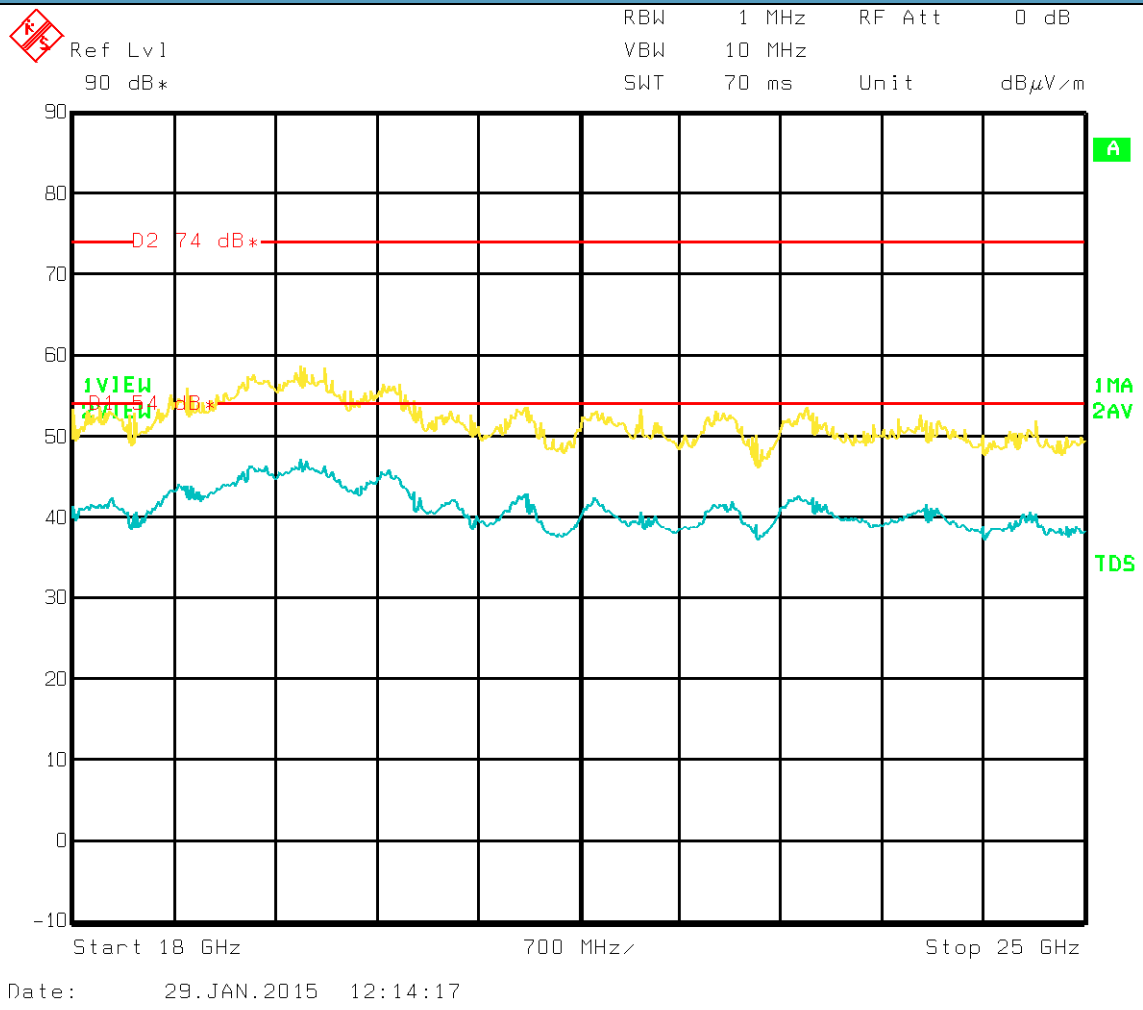
Test data, continued



Ch 1 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

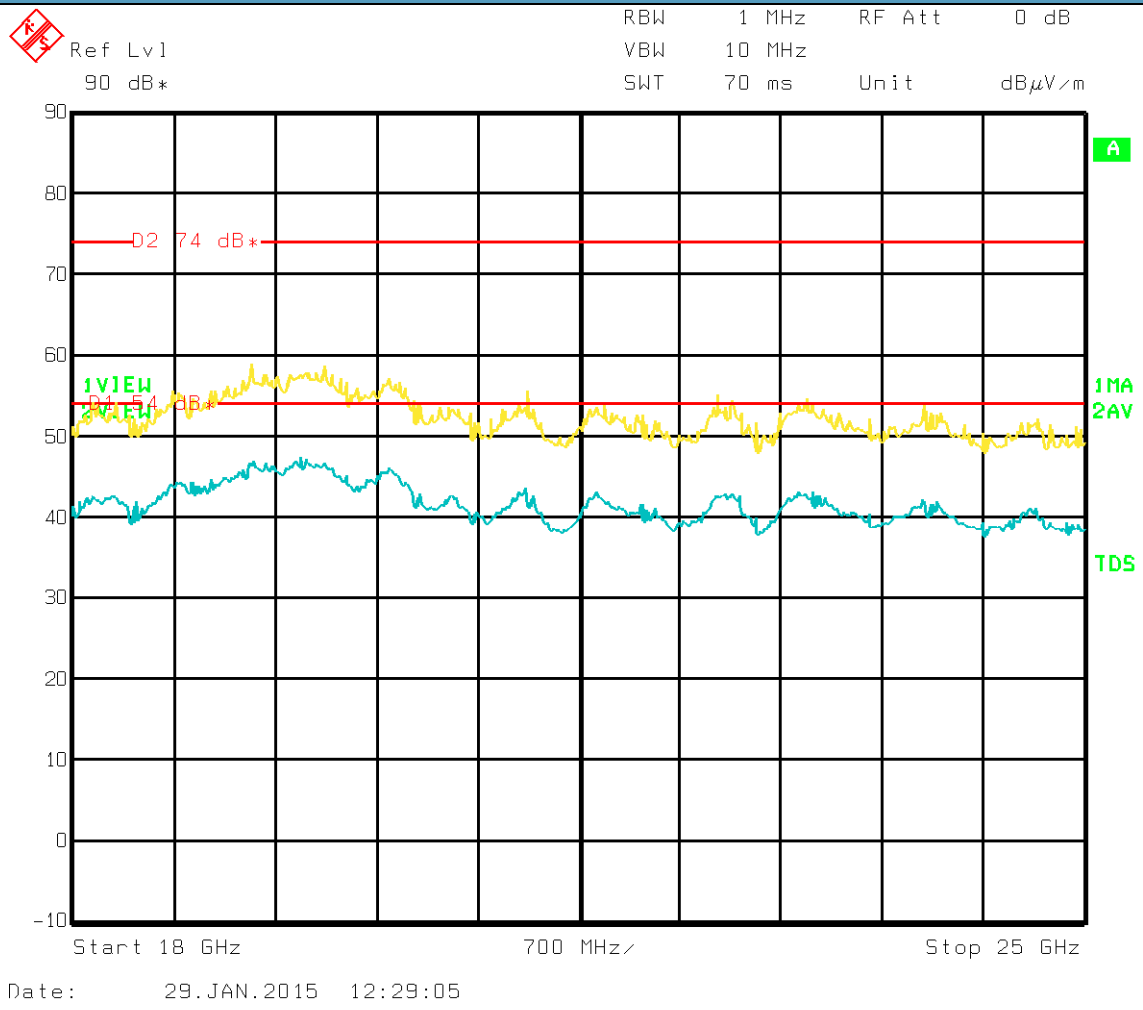
Test data, continued



Ch 1 pol V

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

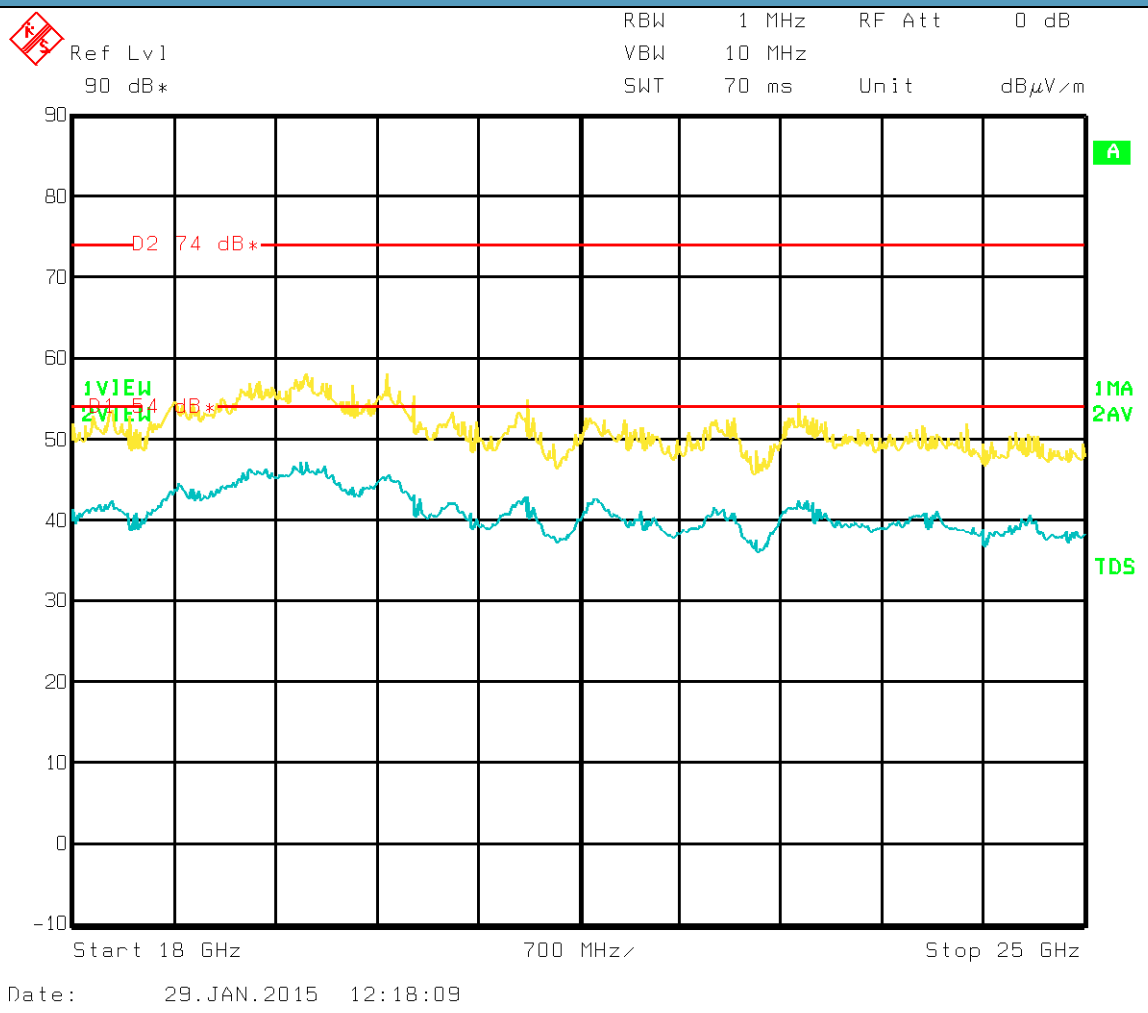
Test data, continued



Ch 20 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

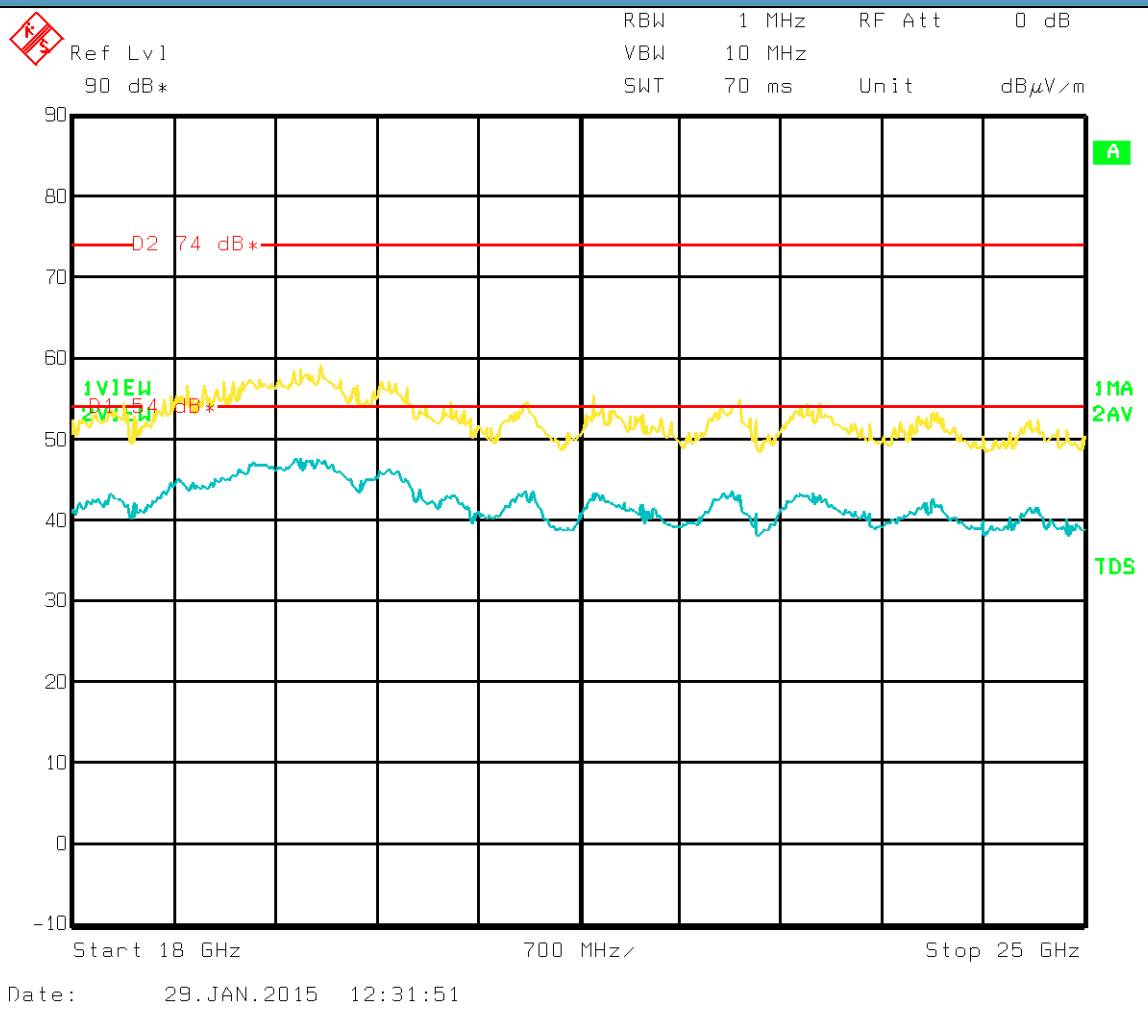
Test data, continued



Ch 20 pol V

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

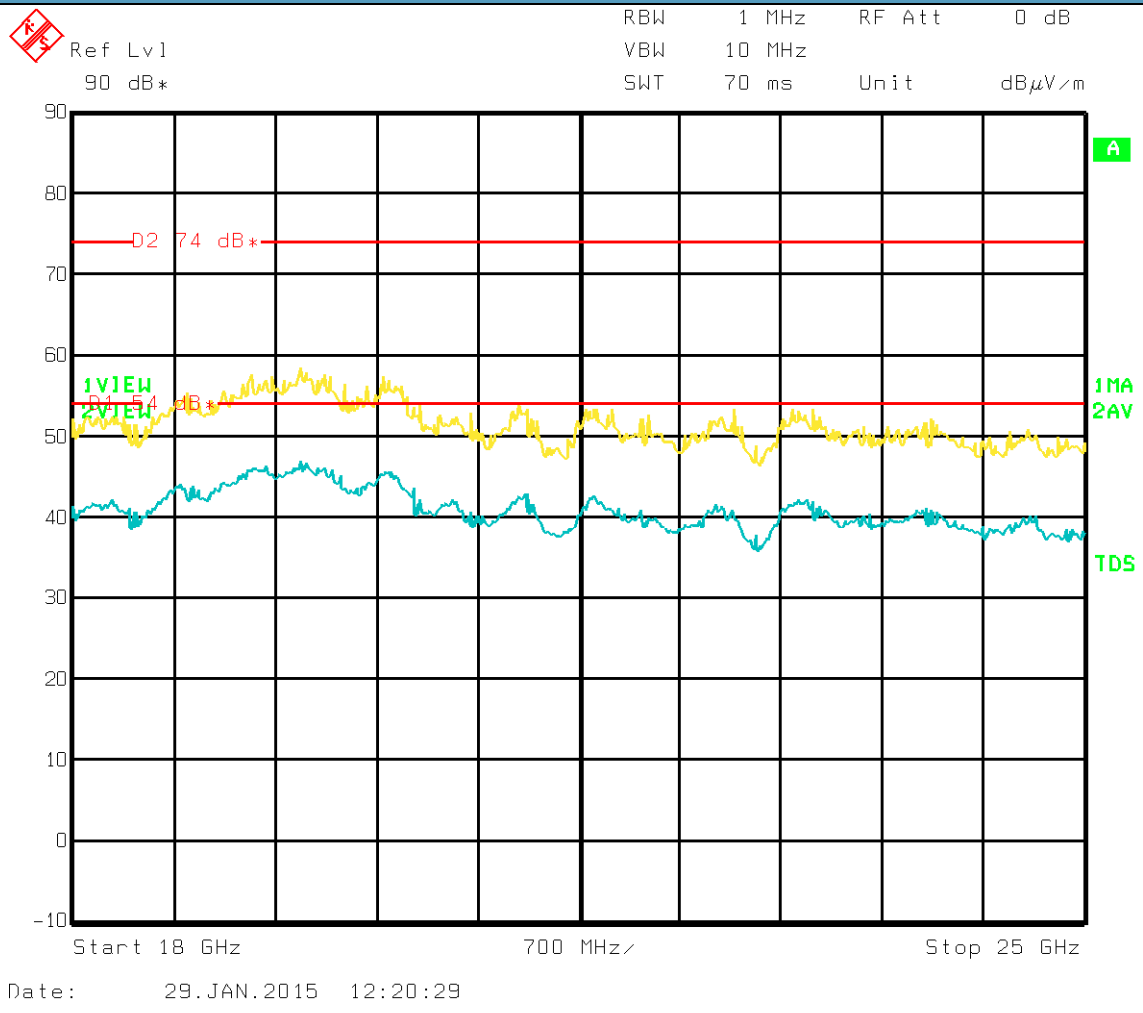
Test data, continued



Ch 39 pol H

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

Test data, continued



Ch 39 pol V

8.9 Clause 15.247(e) Power spectral density for digitally modulated devices

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Special notes

– The test was performed using guidelines of ANSI C63.10-2009, Clause 6.11.2.

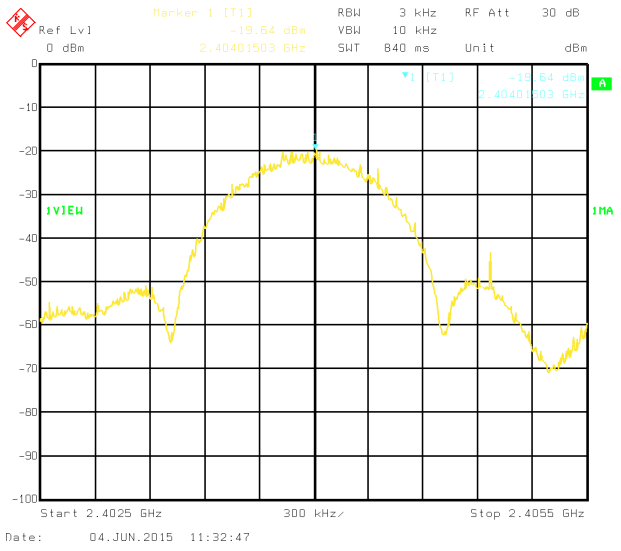
– PSD option 1 was used since output power option 1 was used.
– Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set > RBW. Sweep time was set to Span/3 kHz. Peak level was measured.
– PSD option 2 was used since output power option 2 was used.
– Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set to ≥9 kHz. Sweep time was set to automatic. (Sample detector was used due to bin width < 0.5 RBW and transmission pulse remained at maximum transmit power throughout 100 sweeps of averaging.) Peak detector was used. Average tracing over 100 sweeps in power averaging mode.

Test Name: Clause 15.247(d) Spurious emissions
Test date: 2015-01-29 **Verdict::** Pass
Test engineer: G. Curioni
Temperature: 24 °C **Air pressure:** 989 mbar **Temperature:** 24 °C
Specification: FCC Part 15 Subpart C

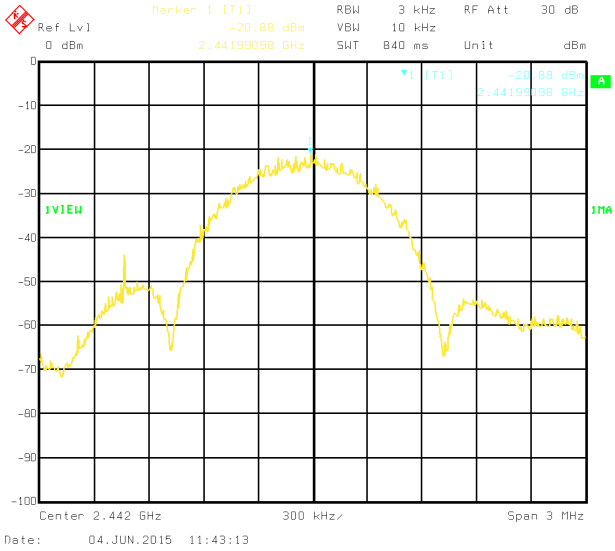
Test data

Conducted measurement

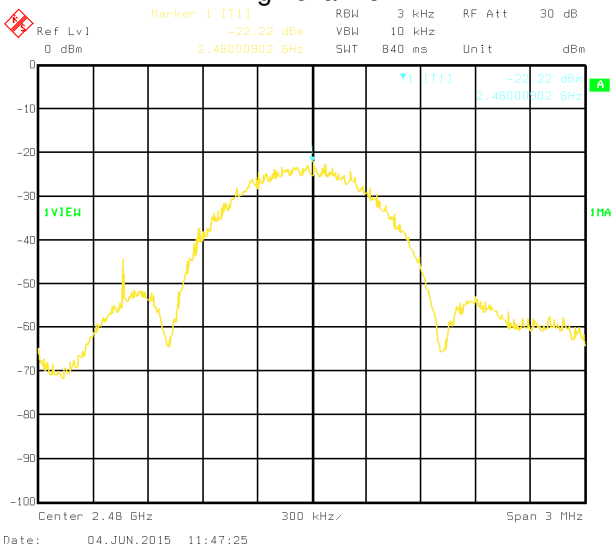
Low channel



Mid channel



High channel



Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
2404	-19.64	8.0	27.64
2442	-20.88	8.0	28.88
2480	-22.22	8.0	30.22

Sweep time = Span/RBW
Sweep time = (300 kHz/3 kHz)
Sweep time = 100 s

8.10 Clause 15.247(i) Radio frequency energy exposure

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

Special notes

None

Test data

MPE (Maximal Permissible Exposure) caclulation

Max Power Density[1] (S) = **10 W/m²**

Calculated Power Density (W/m²)

$$S = \frac{PG}{4\pi R^2}$$ = **0,000259 W/m²** @ 20 cm distance

Calculated minimum safety distance (m)

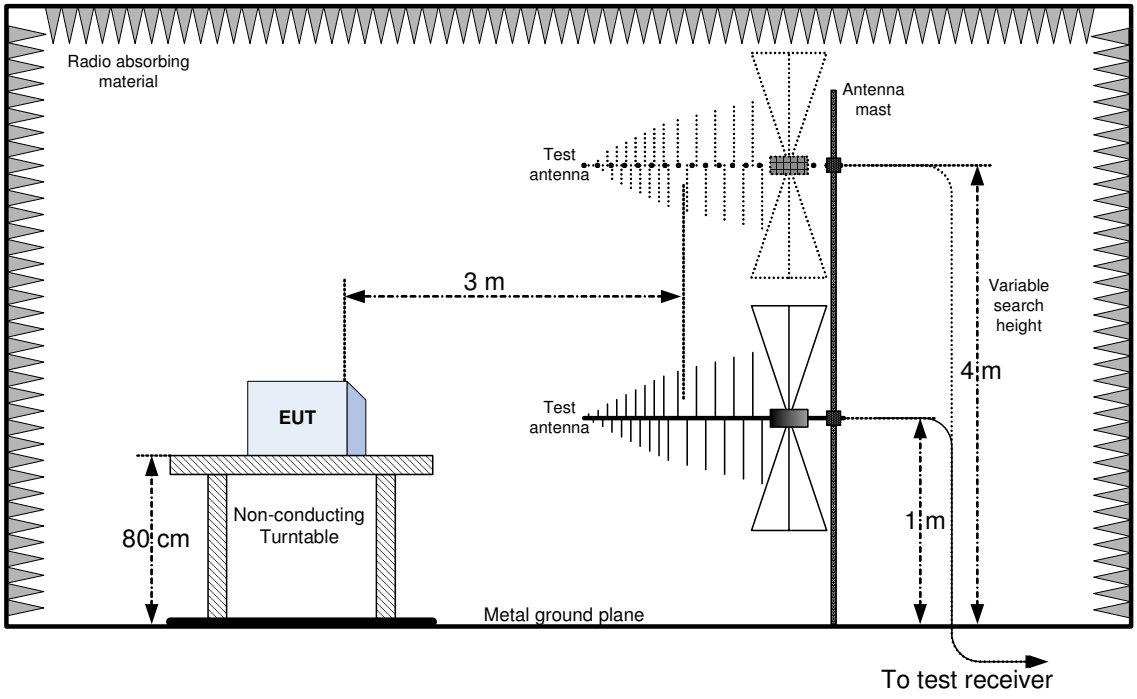
$$r = \sqrt{(PG/4\pi S)}$$ = **0,00109 m**

r	= minimum safety distance (m)	= 0,00109
P	= Power @ antenna connector (W)	= 0,000187
G	= Antenna Gain (numeric)	= 0,69
S	= Max Power Density[1] (W/m²)	= 10

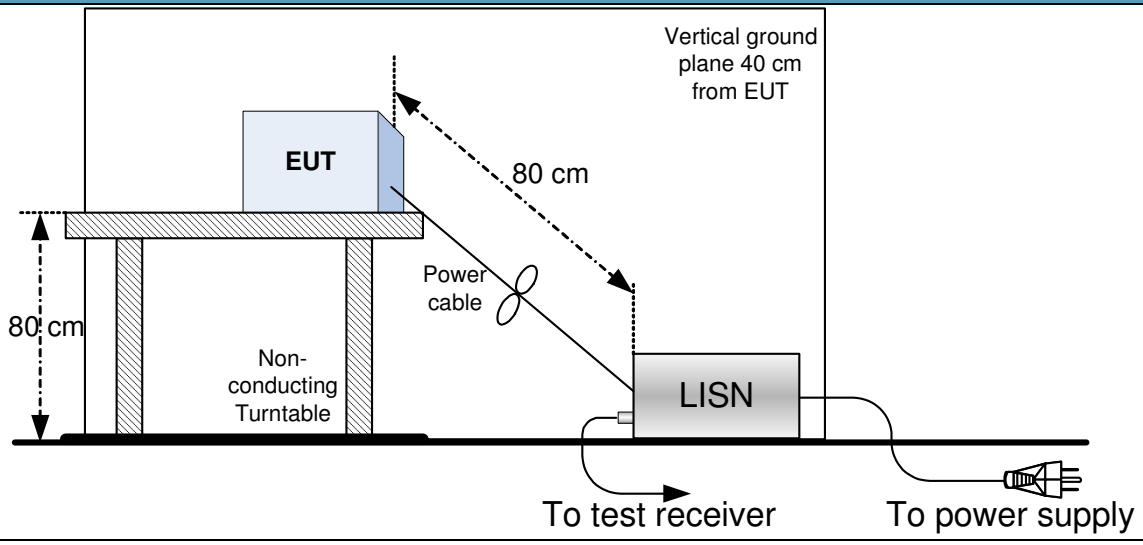
Note:
1) Maximum Power density according to OET Bullettin 65.

Section 9: Block diagrams of test set-ups

Radiated emissions set-up

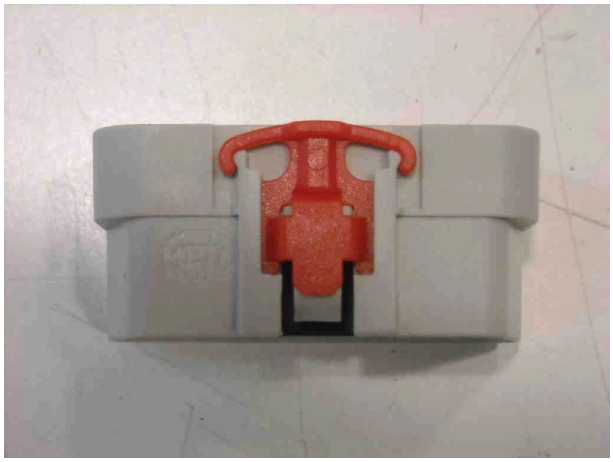
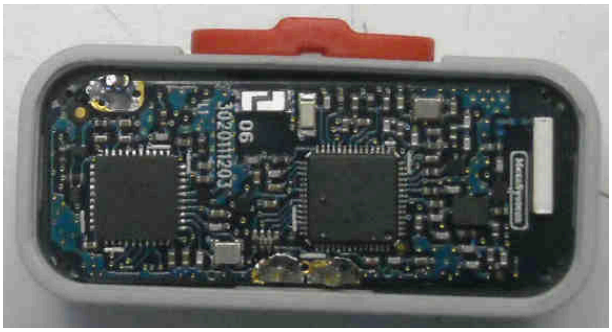


Conducted emissions set-up

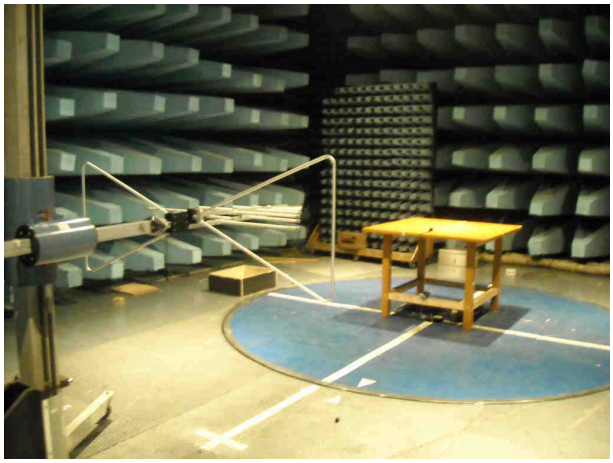


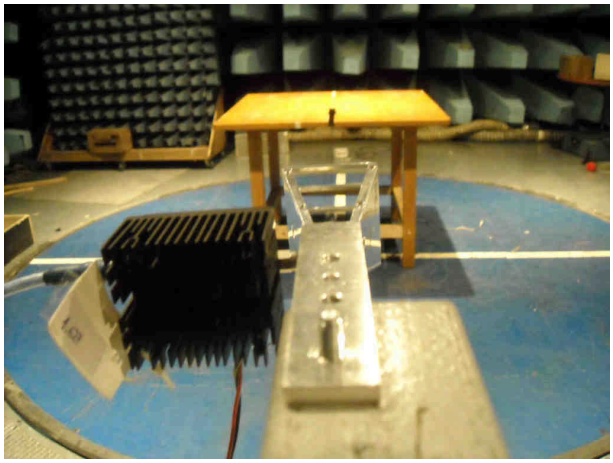
Section 10: Photos

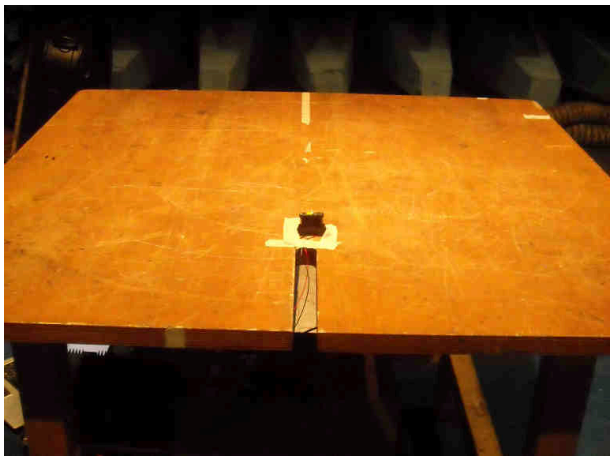
EUT photos

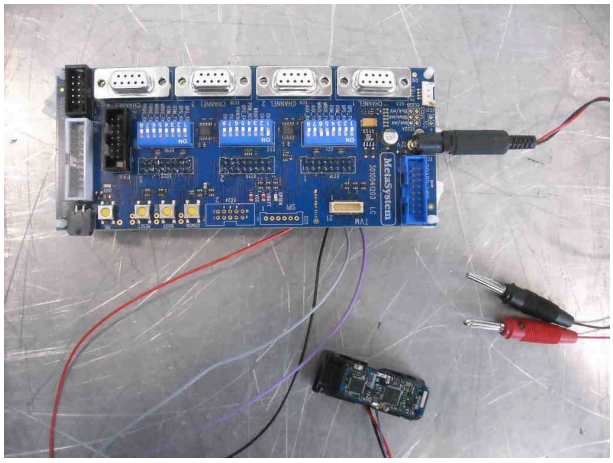
EUT Set-up photos







Photos of Accessories & support equipment



Test JIG

End of report