FCC ID:L2C0048TR

EMI – TEST REPORT

- FCC Part 15.247, RSS210 -

Deutsche Akkreditierungsstelle D-PL-12030-01-01

Test Report No. :	**T35119-00-03HS**	30. September 2011 Date of issue

Type / Model Name : DEA 365 Low BT Radio

Product Description : Radio receiver with BT Interface

Applicant : Delphi Deutschland GmbH

Address : Albert-Einstein-Str. 5

51674 WIEHL, GERMANY

Manufacturer : Deltronicos de Matamoros SA de CV

Address : Delphi Electronics & Safety

Sendero Nacional KM 3.5

Apdo Postal 632 H, Matamoros

Tamaulipas 87350 Mexico

Licence holder : Delphi Deutschland GmbH

Address : Albert-Einstein-Str. 5

51674 WIEHL, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

ilac-MRA

FCC ID:L2C0048TR

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2010)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2010)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment
DA 00-705	Filing and measurement guidelines for FHSS systems

SUMMARY

1.1 Test result summery

Bluetooth device using frequency hopping:

Operating in the 2402 MHz – 2480 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 7.2.4.	AC power line conducted emissions	not applicable
15.247(a)(1)	RSS210, A8.1(a)	20 dB EBW	passed
15.247(a)(1)	RSS-210, A8.1(b)	Channel separation	passed
15.247(a)(1)	RSS-210, A8.1(d)	Dwell time	passed
15.247(b)(1)	RSS-210, A8.4(2)	Peak power	passed
15.247(d)	RSS-210, A8.5	Spurious emissions	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 7.2.2	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	Hopping sequence	passed
15.247(a)	RSS-210, A8.1(b)	Receiver input bandwith	passed
15.247(a)	RSS-210, A8.1(d)	Number of hopping channels	passed
15.247(a)	-	Equal hopping frequency use	passed
15.35(c)	RSS-Gen, 4.5	Pulsed operation	not applicable
15.247(i)	RSS 102, 2.5.2	MPE	passed
15.247(b)(4)	RSS-Gen, 7.1.2	Antenna requirement	passed
15.107	RSS Gen, 7.2.4.	AC power line conducted emissions	passed
15.109(a)	RSS-Gen, 6.1	Receiver spurious emissions, radiated	passed
-	RSS-Gen, 7.2.6	Transmitter frequency stability	not applicable
OET Bulletin 65	RSS102, 3.2	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:
RSS Gen, Issue 3, December 2010
RSS 210, Issue 8, December 2010
RSS 102, Issue 4, March 2010

FCC ID:L2C0048TR

GENERAL REMARKS:

The EUT use a Blue Core5 Chip set which is fully compliant to Bluetooth V2.1+EDR and has an integrated chip antenna, a temporary connector installed by the manufacturer helps to perform most of the measurements conducted.

Items	Description
BT Chip set	Blue Core 5 (CSR)
Power type	12 VDC car application
Modulation	FHSS (GFSK / π/4-DQPSK / 8DPSK)
Frequency range	2402 MHz to 2480 MHz
Channel numbers	79
Data rate (Mbps)	1 (GFSK), 2 (π/4-DQPSK), 3 (8DPSK)
Bluetooth version	V2.1+EDR
Bluetooth conformance test	approved
Antenna type	Integrated multilayer chip antenna (ALA3221C3), peak gain 2.3 dBi

Operation modes:

- synchronous mode (SCO or eSCO traffic, for HV, DV or DM packets) for transmitting voice or data,
- asynchronous mode (ACL traffic, for DM or DH packets) for transmitting data,
- mixed transfer mode (for voice and data,

The most important mode is the ACL mode at a data rate of 3 Mbps for the worst case.

Packets:
A summery of the packets in ACL mode and their characteristics is shown in the following table:

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Symmetric Max. Rate (kb/s)	Asymmetric Max. Rate (kb/s)	
						Forward	Reverse
DM1	1	0-17	2/3	yes	108.8	108.8	108.8
DH1	1	0-27	no	yes	172.8	172.8	172.8
DM3	2	0-121	2/3	yes	258.1	387.2	54.4
DH3	2	0-183	no	yes	390.4	585.6	86.4
DM5	2	0-224	2/3	yes	286.7	477.8	36.3
DH5	2	0-339	no	yes	433.9	723.2	57.6
AUX1	1	0-29	no	no	185.6	185.6	185.6
2-DH1	2	0-54	no	yes	345.6	345.6	345.6
2-DH3	2	0-367	no	yes	782.9	1174.4	172.8
2-DH5	2	0-679	no	yes	869.1	1448.5	115.2
3-DH1	2	0-83	no	yes	531.2	531.2	531.2
3-DH3	2	0-552	no	yes	1177.6	1766.4	235.6
3-DH5	2	0-1021	no	yes	1306.9	2178.1	177.1

Modulation types:
For the DH5 packet the pay load modulation GFSK, for 2-DH5 the modulation π/4-DQPSK, for 3-DH5 the modulation 8DPSK is used. The packet 3-DH5 shows most of modulation side bands and means the worst case.

FCC ID:L2C0048TR

Operating frequency range:
The manufacturer declares that the maximum frequency of this device is 2402 MHz to 2480 MHz. This is according the Bluetooth Core Specification 2.1 +EDR (+ critical errata) for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04-E). Other frequency ranges (e.g. for Spain, France, Japan) are not supported by this device.

Test software:
The specific settings for the several mesurements could be done with the Software “Bluesuit3” runs on PC. The contol of the Bluetooth chip is via LPT1 to a special PCB which translates the singnals to a serial bus which is wired by the manufacturer directly to the EUT. Power setting 48, 101010.. pattern.

The frequency range was scanned from 4 MHz to 25000 MHz. All emissions not reported in this test report are more than 20 dB below the specified limit.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 14 June 2011

Testing concluded on : 27 June 2011

Checked by:

Thomas Weise
I confirm the correctness and integrity of this document
2011.09.30 12:16:54 +02'00'

Thomas Weise
Dipl. Ing.(FH)
Laboratory Manager

Tested by:

Hermann Smetana
I am the author of this document
2011.09.30 09:53:42 +02'00'

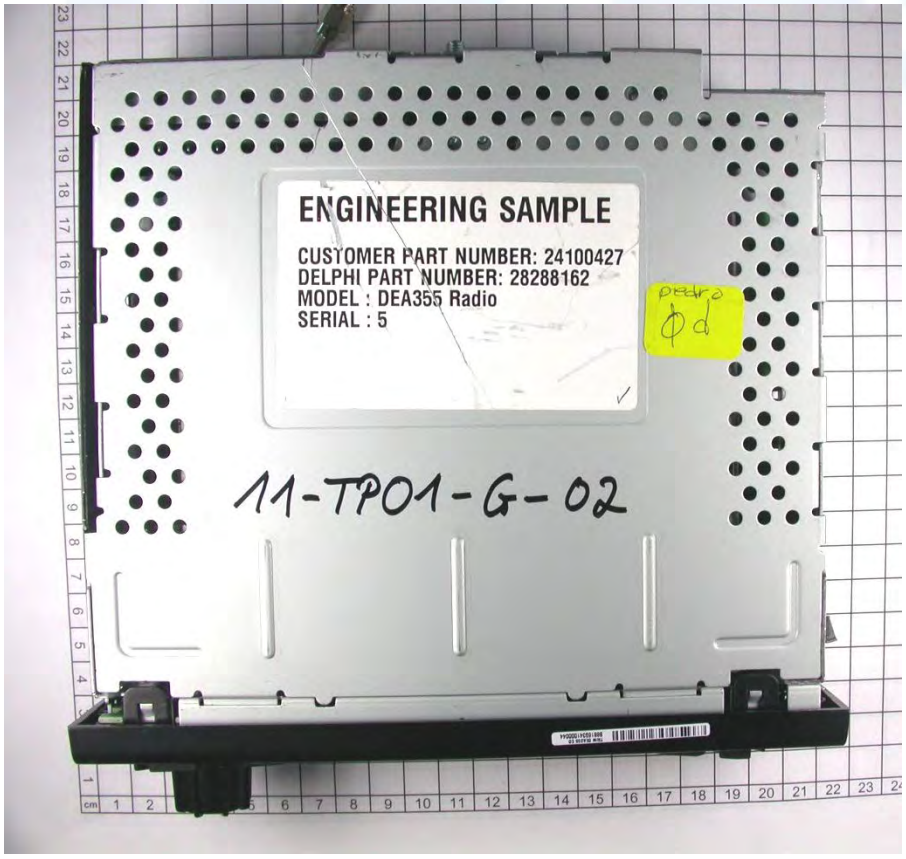
Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT

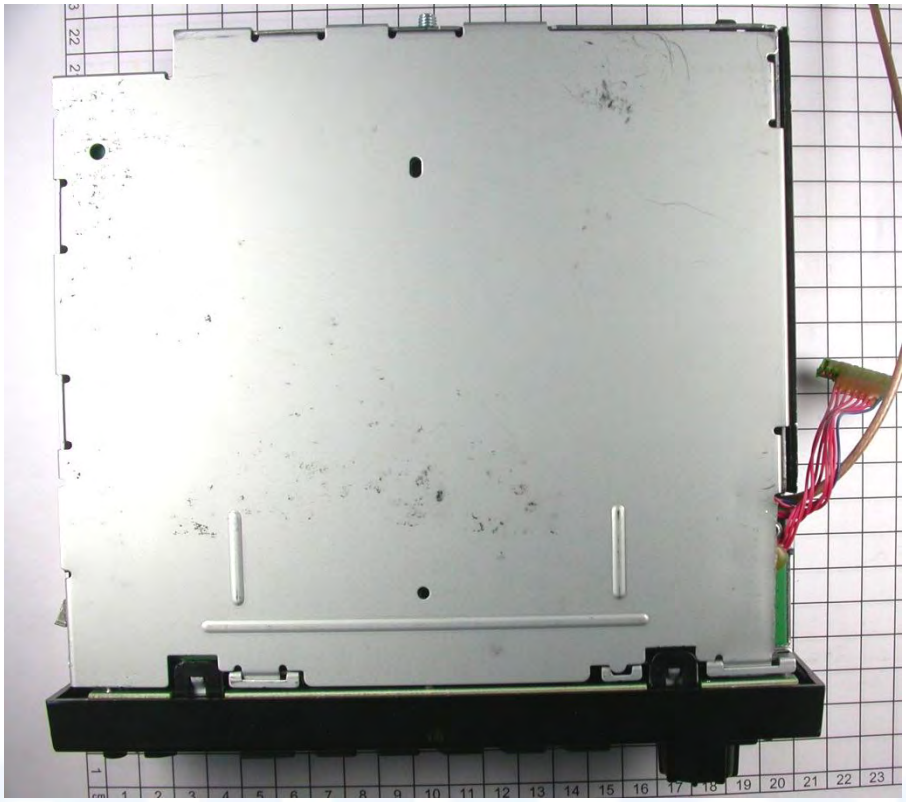
External view:

Top view:



FCC ID:L2C0048TR

Button view:

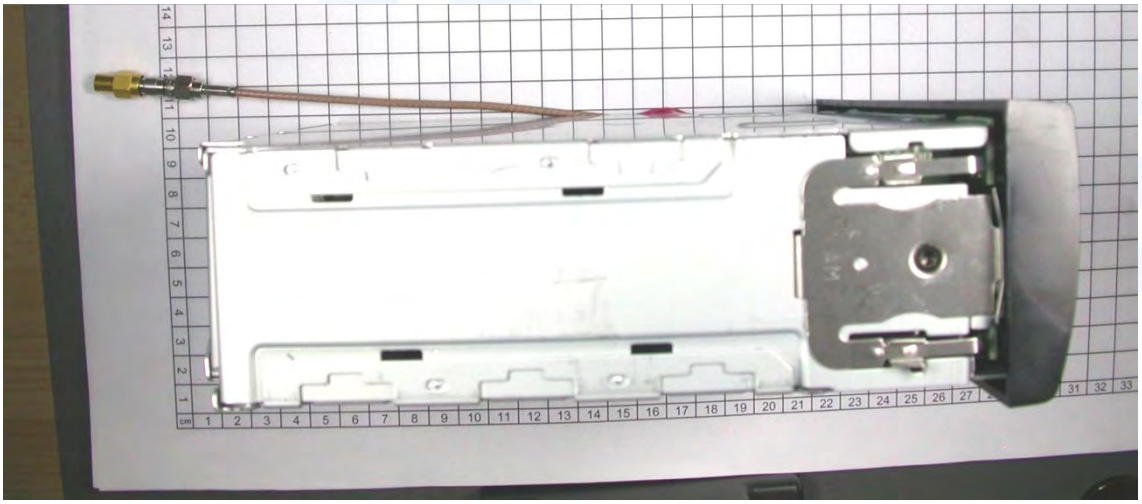


USB interface:

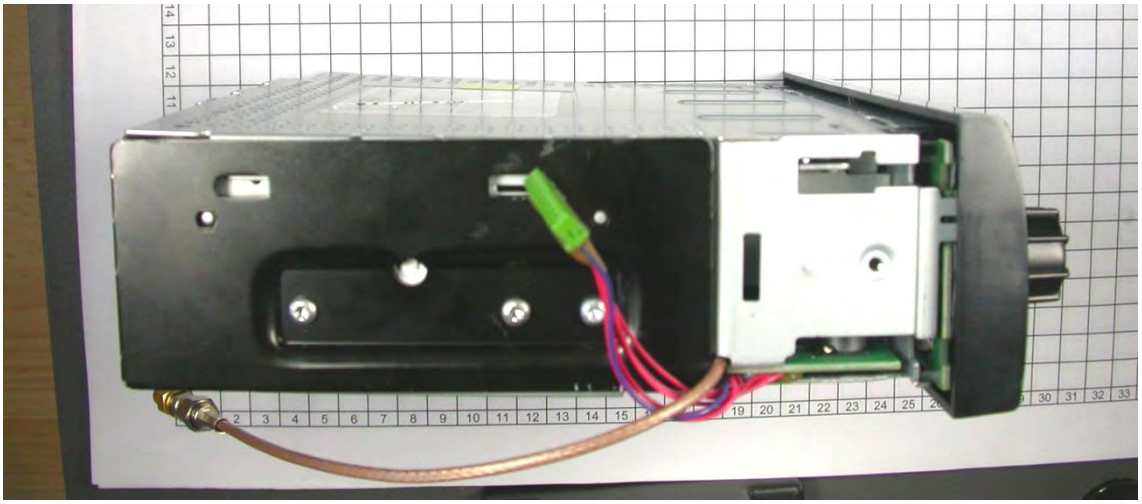
FCC ID:L2C0048TR

Rear view:

Right hand side:

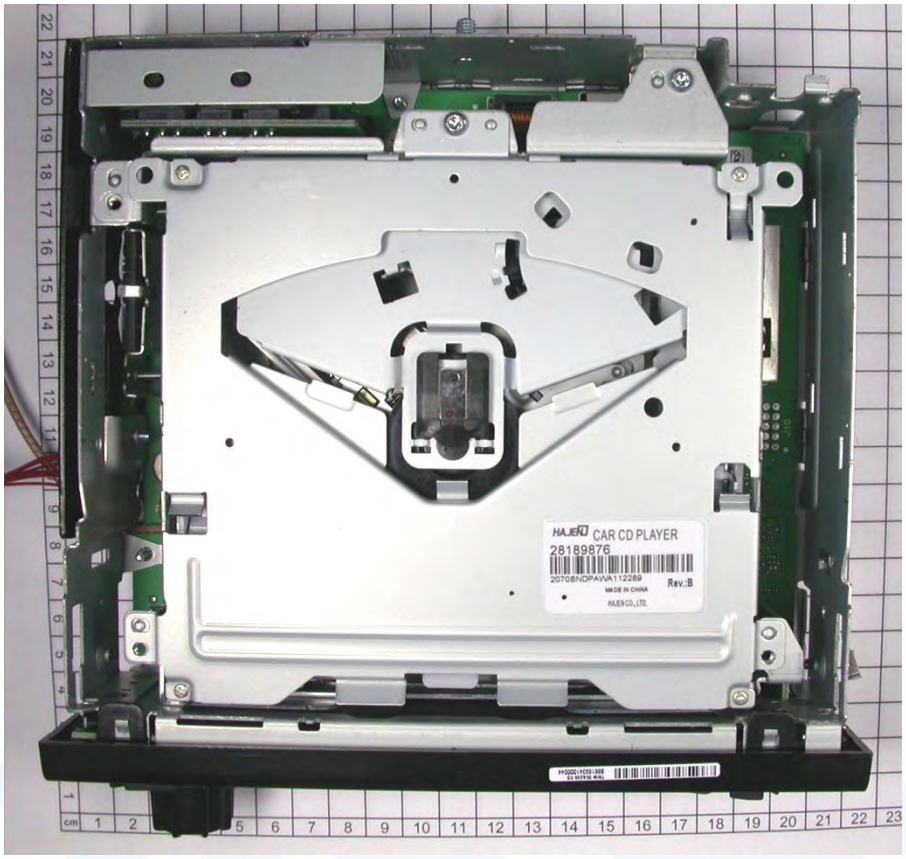


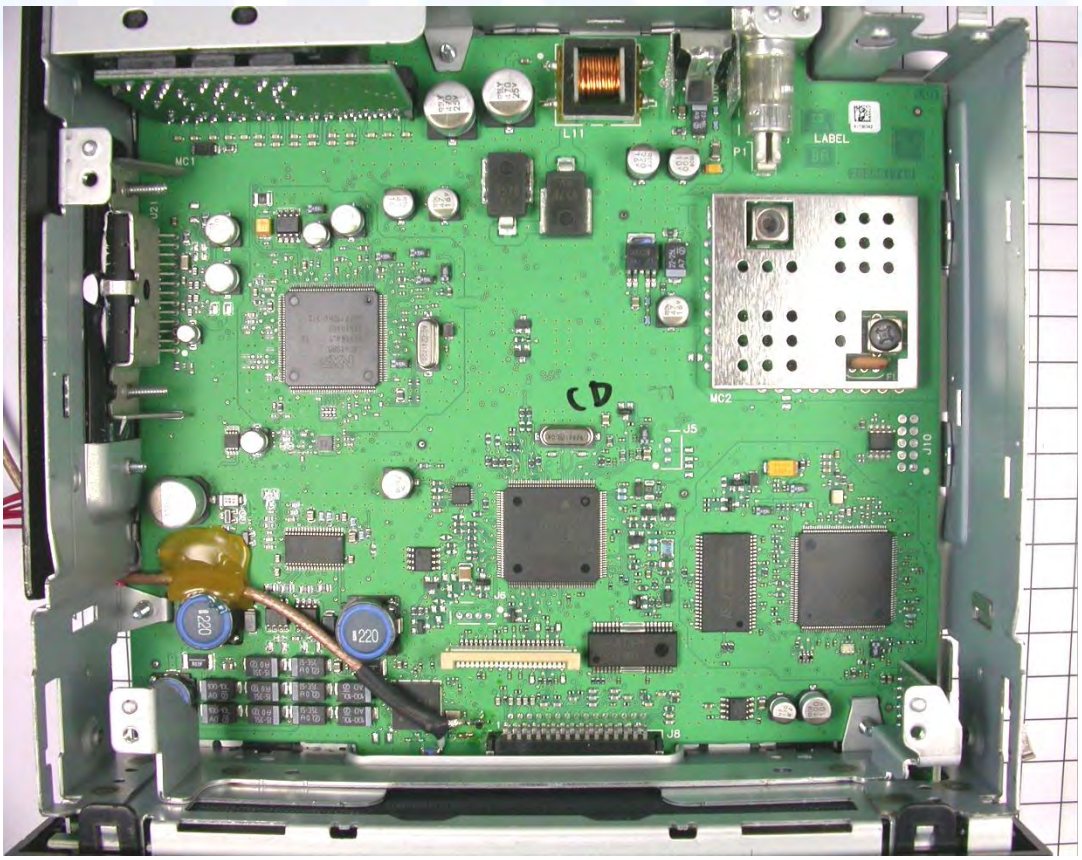
Left hand side:



FCC ID:L2C0048TR

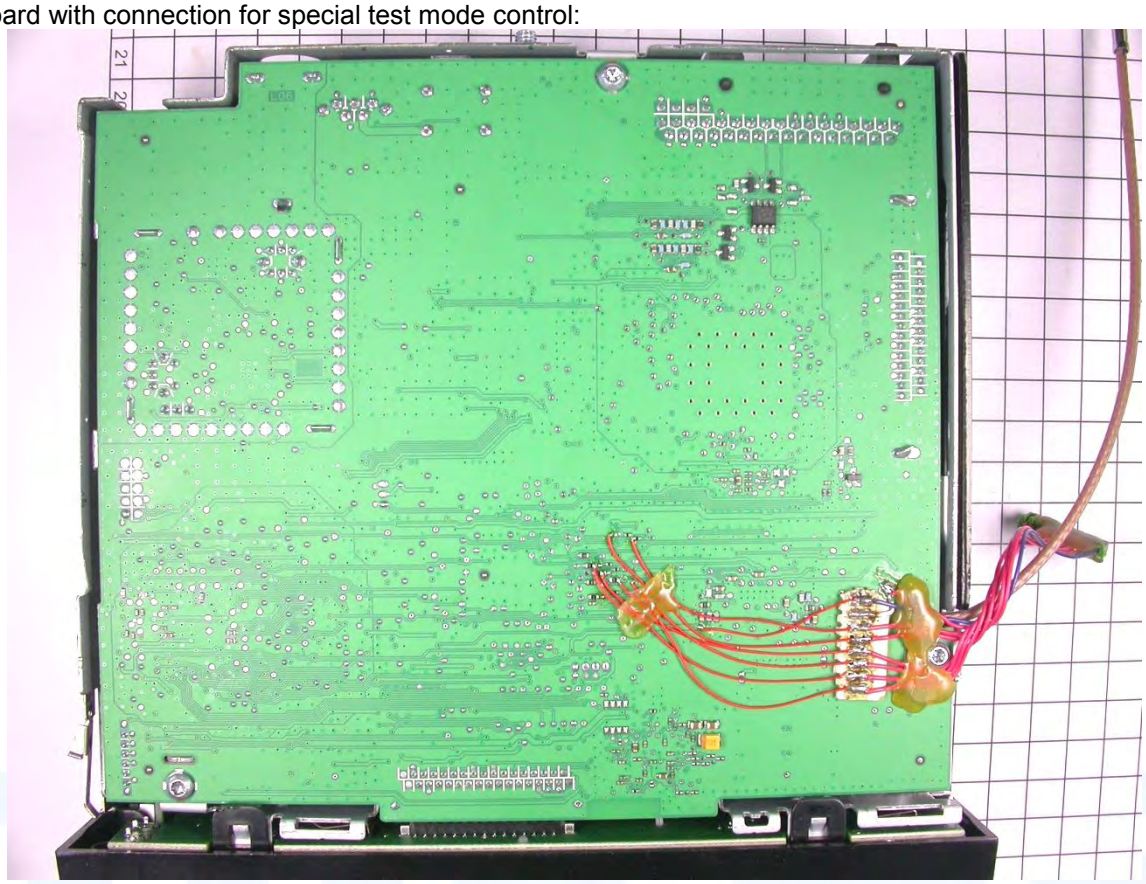
Internal view:

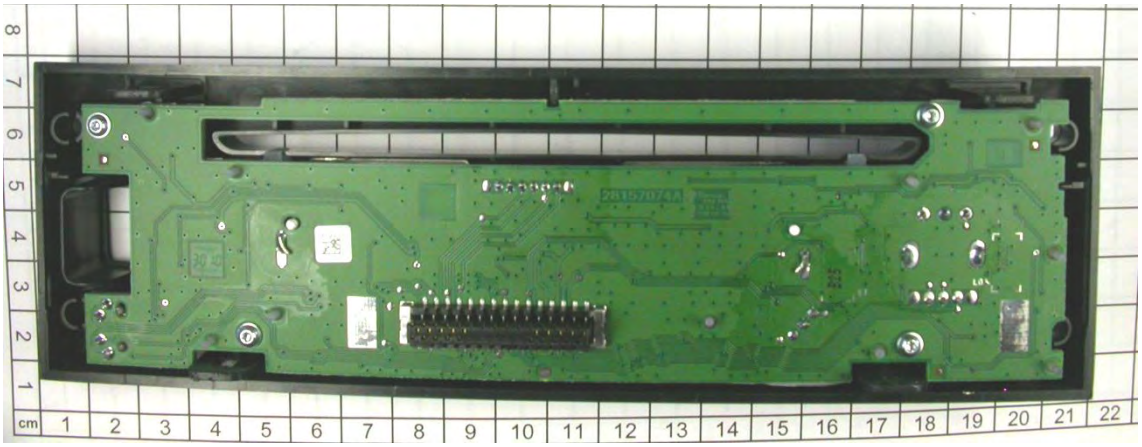




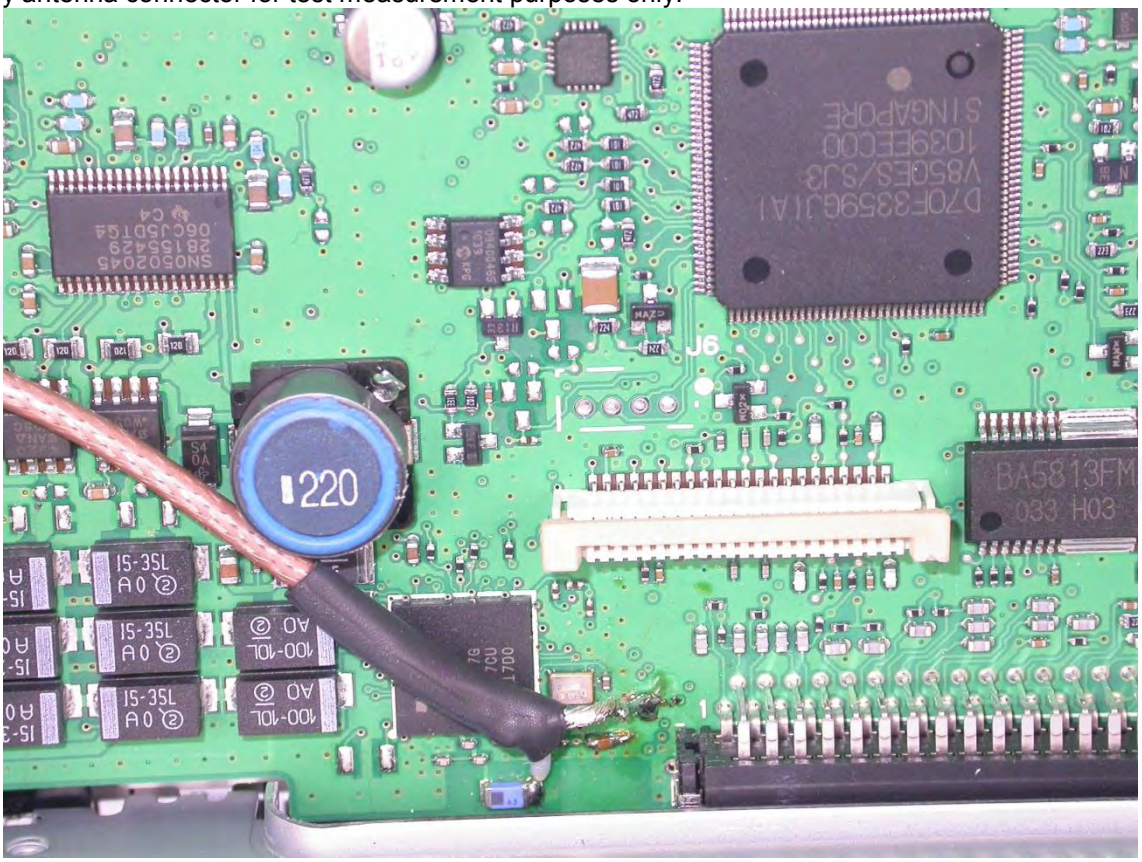
FCC ID:L2C0048TR

Motherboard with connection for special test mode control:





Temporary antenna connector for test measurement purposes only:



2.2 Power supply system utilised

Power supply voltage: : 12 VDC (car application)

2.3 Short description of the EUT

The EUT is a car radio receiver with Bluetooth interface. The BT interface can be used for hands free phone calls or audio streaming.

Number of tested samples: 1
Serial number: 5

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX mode, GFSK

- TX mode, π/4-DQPSK

- TX mode, 8DPSK

- RX mode continuous

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- Automotive wiring harness Model : Made by manufacturer
- Control box for setting special test modes Model : Made by manufacturer
- Note book with test software Model : Siemens Lifebook

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 Strasskirchen
Germany

3.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

3.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

3.4 Measurement protocol for FCC and IC

3.4.1 GENERAL INFORMATION

3.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 Issue 8 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

3.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

3.4.1.3 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - " Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

3.5 Determination of worst case measurement conditions

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position with the following settings:

Following channels and test modes were selected for the final test as listed below:

Technology	Available channels	Tested channels	Modulation	Packet type
Bluetooth	1 - 79	1, 40, 79	GFSK	DH5
Bluetooth	1 - 79	1, 40, 79	π/4-DQPSK	2-DH5
Bluetooth	1 - 79	1, 40, 79	8DPSK	3-DH5

4 TEST CONDITIONS AND RESULTS

4.1 Conducted emissions

For test instruments and accessories used see section 6 Part **A 4**.

4.1.1 Description of the test location

Test location: NONE

Remarks: The measurement is not applicable the EUT has no AC mains connection.

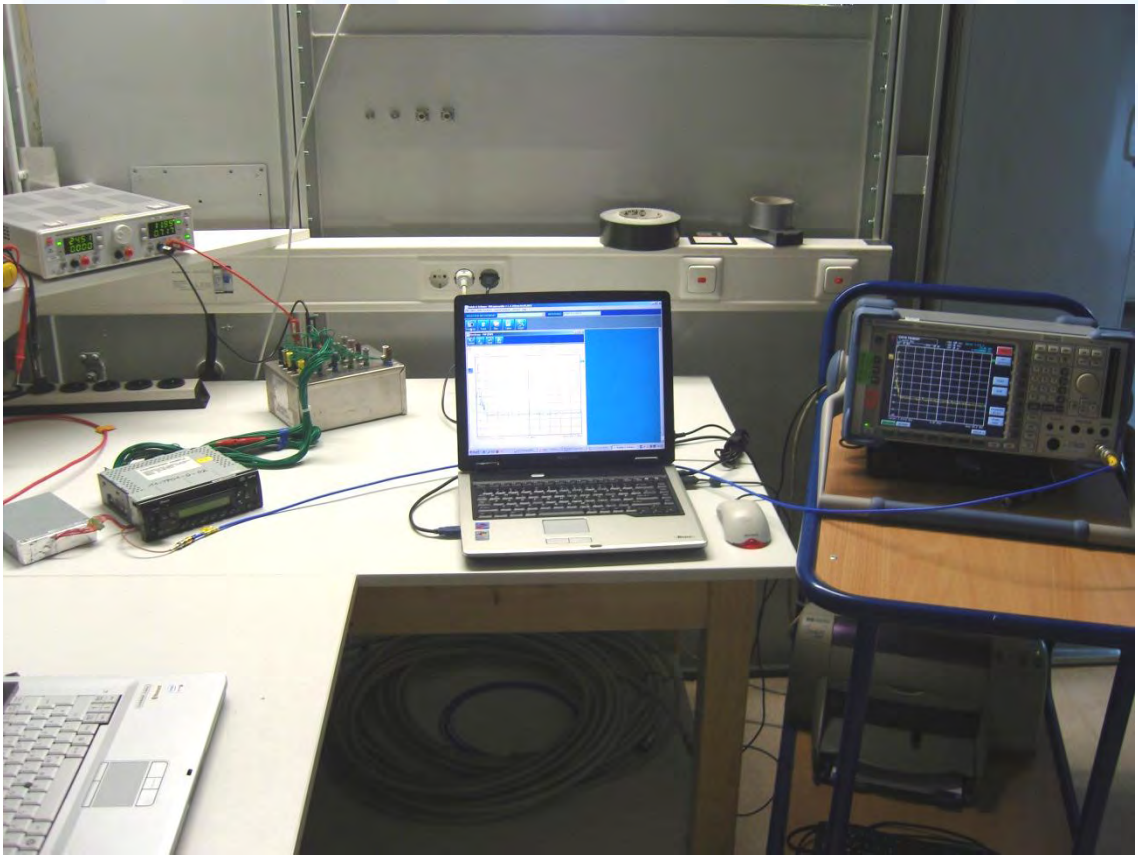
4.2 Emission bandwidth

For test instruments and accessories used see section 6 Part **MB**.

4.2.1 Description of the test location

Test location: AREA 4

4.2.2 Photo documentation of the test set-up



4.2.1 Applicable standard

According to FCC Part 15C, Section 15.247(a):
Frequency hopping systems shall have hopping carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

4.2.2 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB. The reference level is the level of the highest signal amplitude observed from the transmitter at either the fundamental frequency or the first-order modulation products in all typical modes of operation including the unmodulated carrier, even if atypical.
Analyser settings:
RBW: 30 kHz, VBW: 100 kHz, Sweep time: auto, Detector: Peak, Trace mode: Max hold

4.2.3 Test result

DH5 Packet

Channel No.	20 dB Bandwidth (kHz)
CH1	1050
CH40	1050
CH79	1050

2-DH5 Packet

Channel No.	20 dB Bandwidth (kHz)
CH1	1160
CH40	1180
CH79	1170

3-DH5 Packet

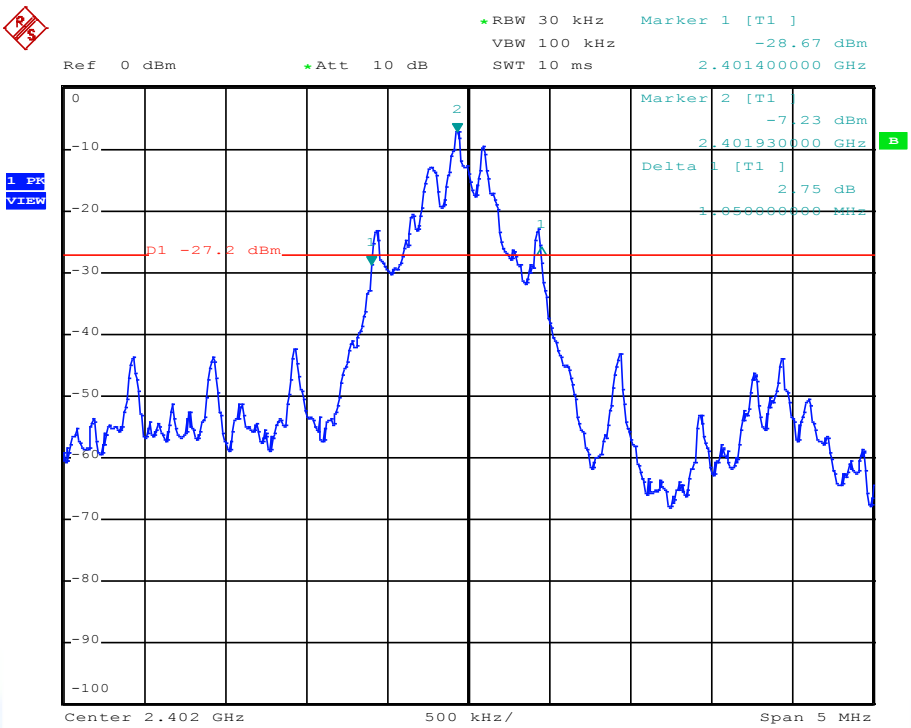
Channel No.	20 dB Bandwidth (kHz)
CH1	1190
CH40	1190
CH79	1190

There is no bandwidth limit according to FCC Part15C, Section 15.247(a).

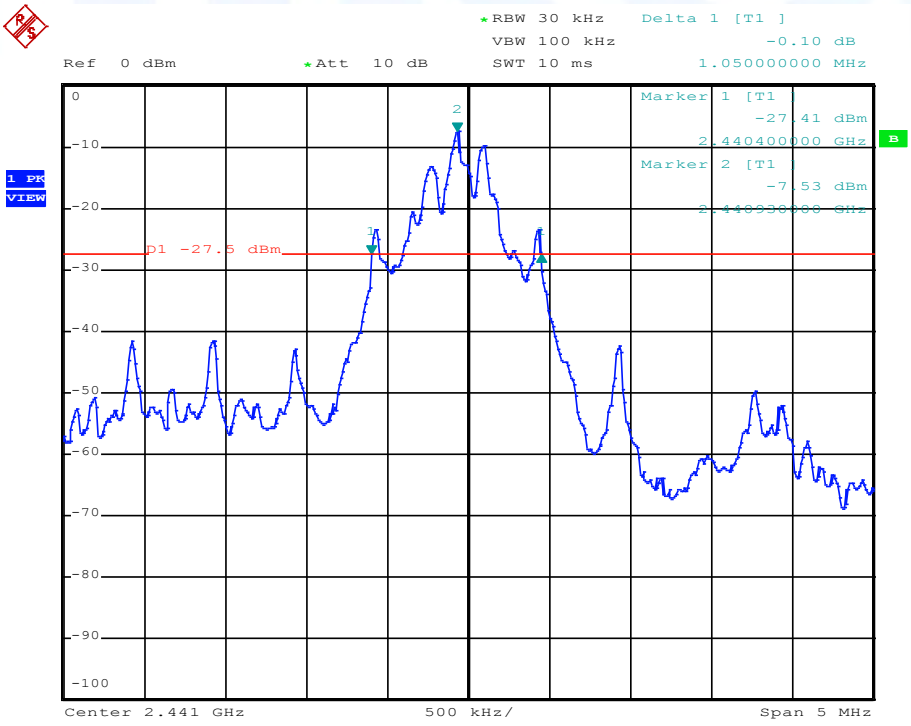
Remarks: For detailed test result please refer to following test protocols.

4.2.4 Test protocol

Emission bandwidth, channel 1, DH5 Packet

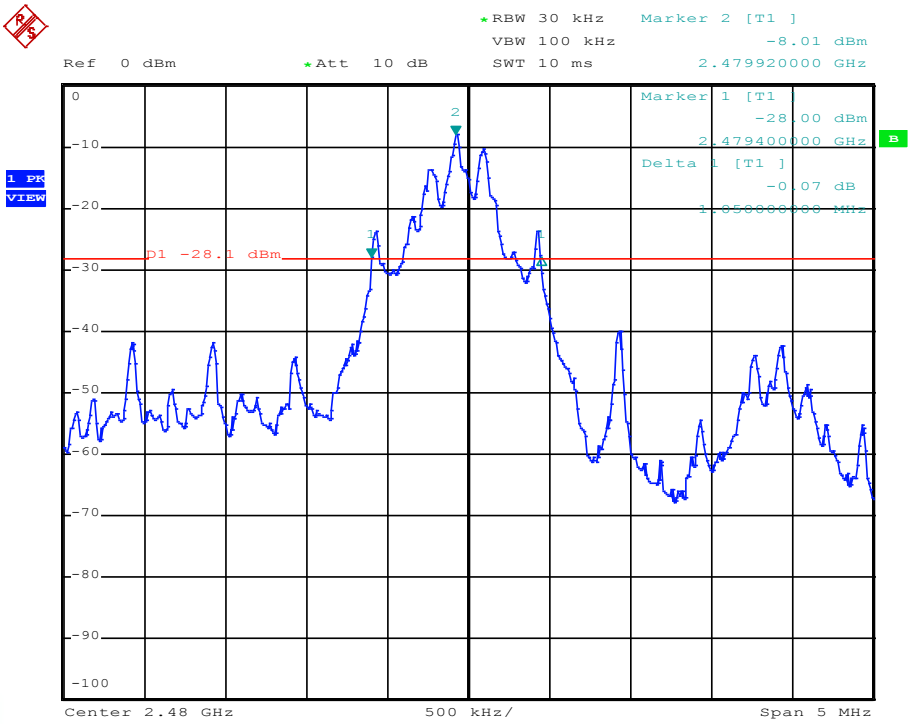


Emission bandwidth, channel 40, DH5 Packet

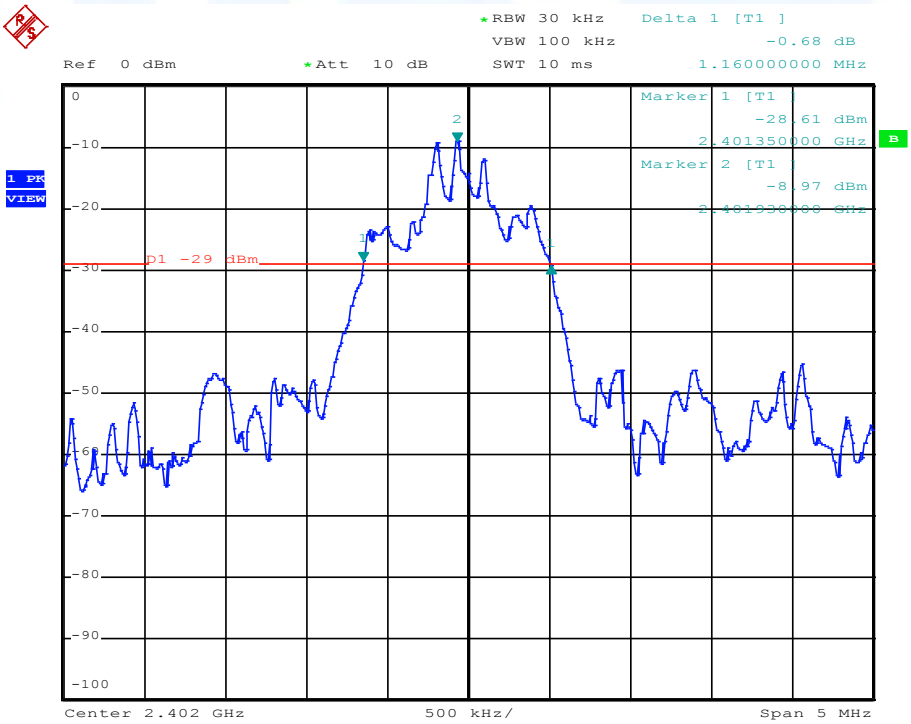


FCC ID:L2C0048TR

Emission bandwidth, channel 79, DH5 Packet

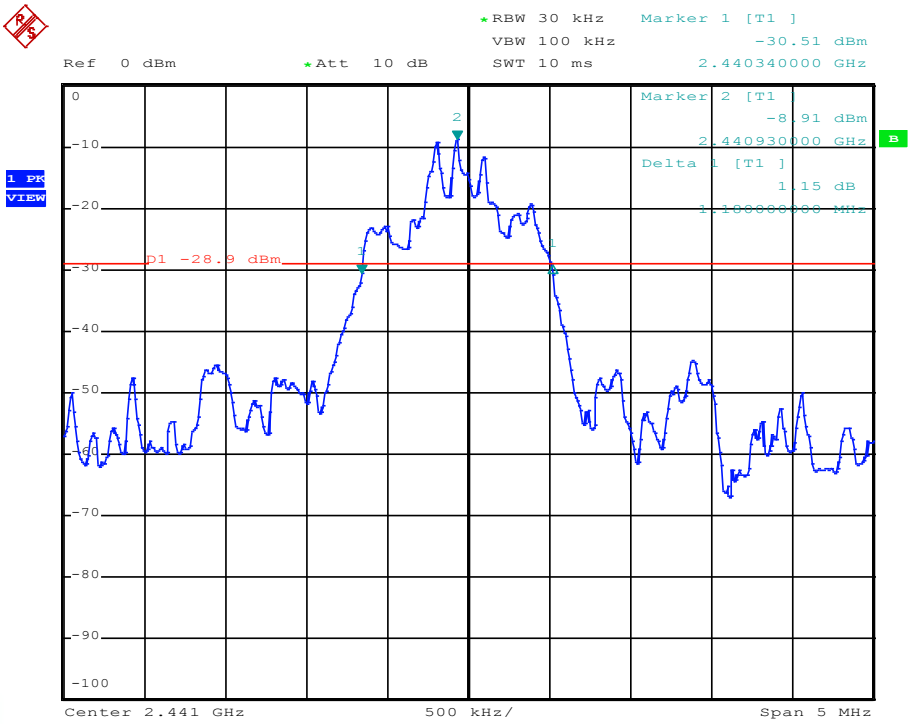


Emission bandwidth, channel 1, 2-DH5 Packet

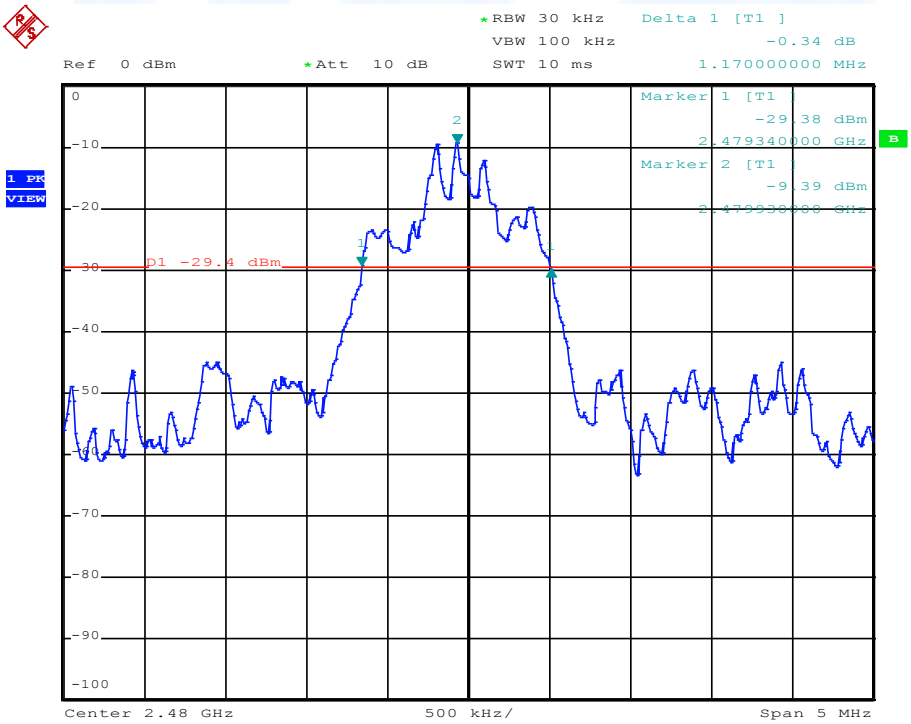


FCC ID:L2C0048TR

Emission bandwidth, channel 40, 2-DH5 Packet

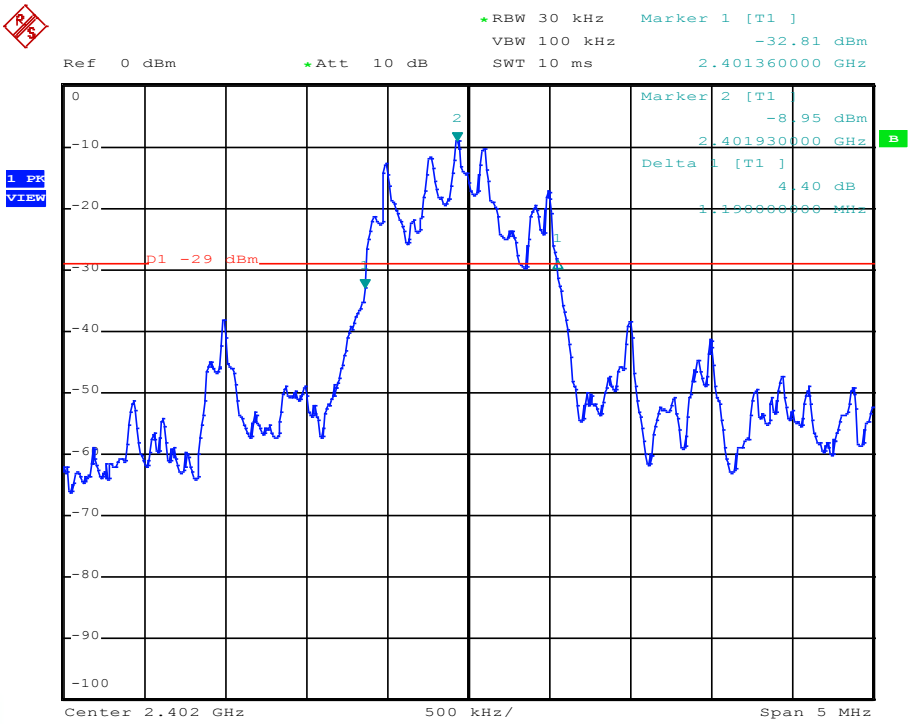


Emission bandwidth, channel 79, 2-DH5 Packet

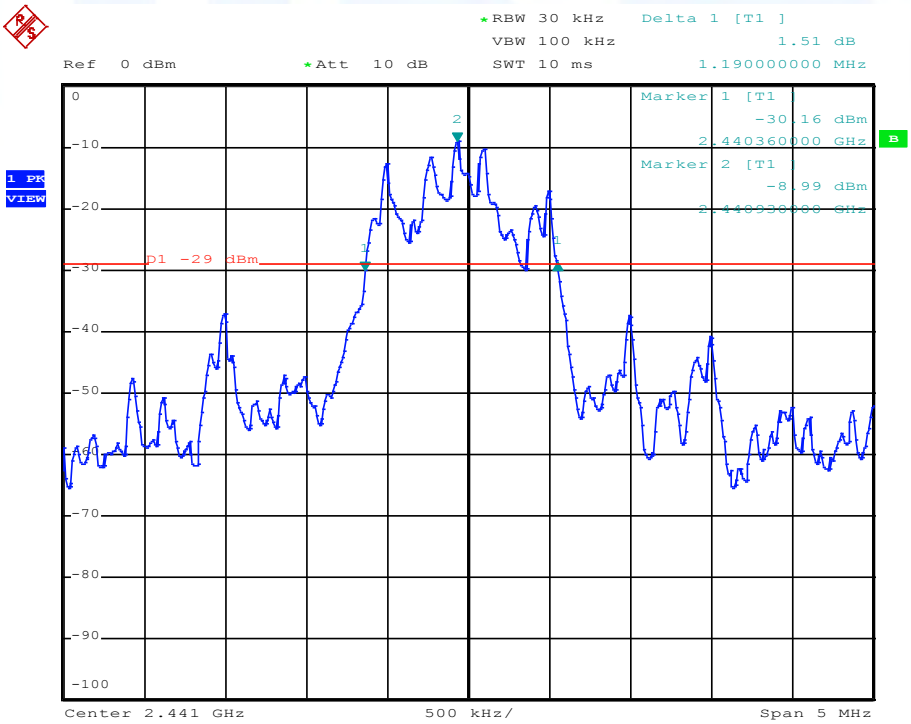


FCC ID:L2C0048TR

Emission bandwidth, channel 1, 3-DH5 Packet

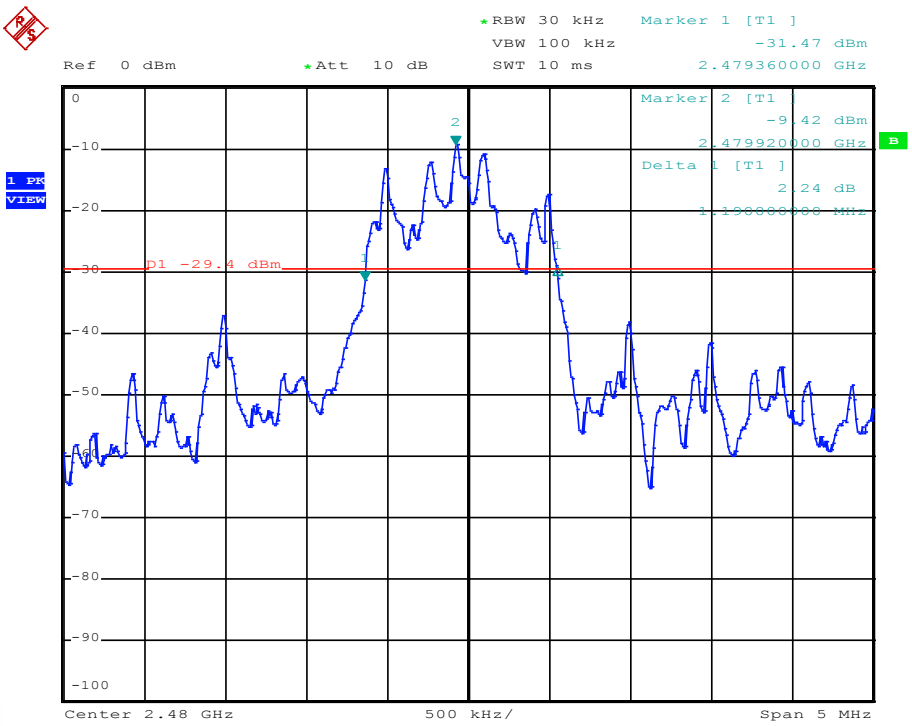


Emission bandwidth, channel 40, 3-DH5 Packet



FCC ID:L2C0048TR

Emission bandwidth, channel 79, 3-DH5 Packet



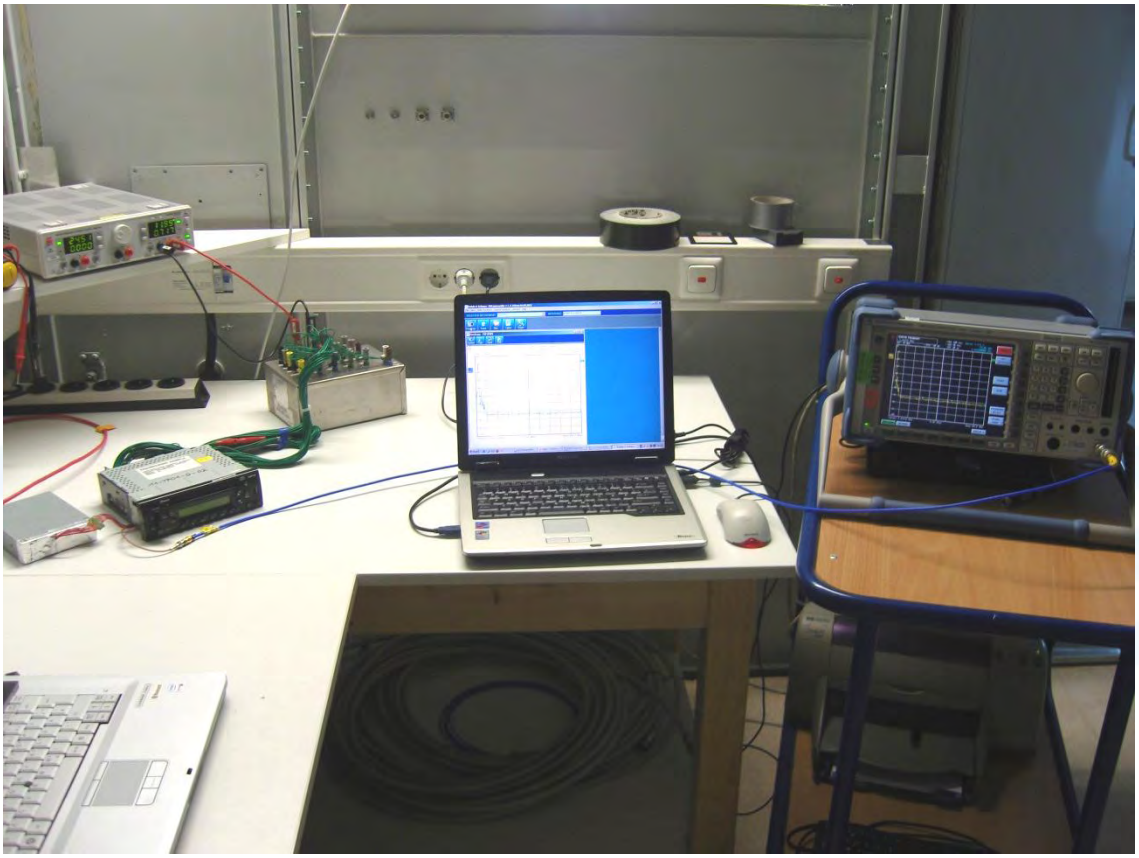
4.3 Maximum peak output power conducted

For test instruments and accessories used see section 6 Part **CPC 3**.

4.3.1 Description of the test location

Test location: AREA 4

4.3.2 Photo documentation of the test set-up



4.3.3 Applicable standard

According to FCC Part 15C, Section 15.247(a)(1):
The maximum peak output power of an intentional radiator shall not exceed the limit defined in dependency of the channel separation and of the number of hopping channels.

4.3.4 Description of Measurement

A spectrum analyser is connected to the output of the transmitter via a suitable attenuator while EUT is operating in transmit mode using the assigned frequency according to DA 00-705. The correction factor takes the cable loss into account.

Analyser settings:
RBW: 3 MHz, VBW ≥ RBW, Detector: Max peak, Trace: Max hold, Sweep time: auto

4.3.5 Test result

DH5 Packet

Channel	Frequency (MHz)	Peak power (dBm)	Correct. (dB)	Corr. peak power (dBm)	Limit (dBm)	Delta (dB)
CH1	2402	-7.1	2.7	-4.4	30	-34.3
CH40	2441	-7.1	2.7	-4.4	30	-34.4
CH79	2480	-7.8	2.7	-5.1	30	-35.1

Note: Cable 02-02/50-06-042, insertion loss @ 2441 MHz, -1.6 dB;

2-DH5 Packet

Channel	Frequency (MHz)	Peak power (dBm)	Correct. (dB)	Corr. peak power (dBm)	Limit (dBm)	Delta (dB)
CH1	2402	-7.8	2.7	-5.1	30	-35.1
CH40	2441	-7.9	2.7	-5.2	30	-35.2
CH79	2480	-8.3	2.7	-5.6	30	-35.6

3-DH5 Packet

Channel	Frequency (MHz)	Peak power (dBm)	Correct. (dB)	Corr. peak power (dBm)	Limit (dBm)	Delta (dB)
CH1	2402	-7.8	2.7	-5.1	30	-35.1
CH40	2441	-7.9	2.7	-5.2	30	-35.2
CH79	2480	-8.3	2.7	-5.6	30	-35.6

Peak Power Limit according to FCC Part 15C, Section 15.247(b)(1):

Frequency	Channel separation	Hop	Peak power limit	
(MHz)		Channels	(dBm)	(Watt)
2400-2483.5	-	≥ 75	30	1

The requirements are **FULFILLED.**

Remarks: _____

_____

4.4 Spurious emissions conducted

For test instruments and accessories used see section 6 Part **SEC1, SEC2 and SEC3**.

4.4.1 Description of the test location

Test location: Shielded Room S4

4.4.2 Applicable standard

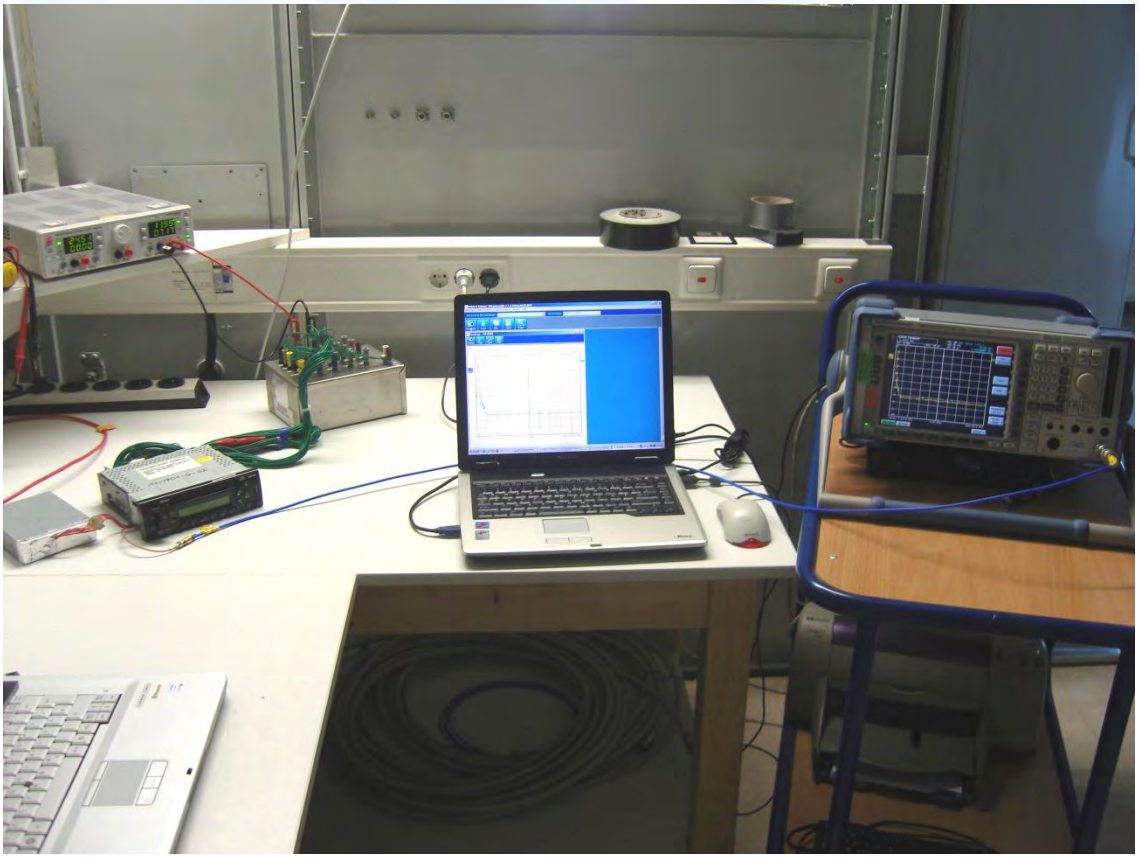
According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.5 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

4.4.3 Description of Measurement

A spectrum analyser is connected to the output of the transmitter via a suitable attenuator while EUT is operating in transmit mode using the assigned frequency according to DA 00-705.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Trace: Max hold, Sweep: auto

4.4.4 Photo documentation of the test set-up



4.4.5 Test result

Lowest frequency generated in the EUT: 4 MHz
Determination of the limit level: CH40, max level = 99.1 dBµV;

DH5 Packet

CH1			CH40			CH79		
f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)
4 - 1000	< 50	79.1	4 - 1000	< 50	79.1	4 - 1000	< 50	79.1
1603	47.9	79.1	1627	47.6	79.1	1654	48.7	79.1
4800	60.6	79.1	4877	62.9	79.1	4954	64.6	79.1
Measurement uncertainty					± 3 dB			

2-DH5 Packet

CH1			CH40			CH79		
f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)
4 - 1000	< 50	79.1	4 - 1000	< 50	79.1	4 - 1000	< 50	79.1
1603	47.9	79.1	1627	47.6	79.1	1654	48.3	79.1
4800	60.8	79.1	4877	62.5	79.1	4954	64.3	79.1
Measurement uncertainty					± 3 dB			

3-DH5 Packet

CH1			CH40			CH79		
f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)	f (MHz)	Level PK (dBµV)	Limit (-20 dB) (dBµV)
4 - 1000	< 50	79.1	4 - 1000	< 50	79.1	4 - 1000	< 50	79.1
1603	47.9	79.1	1627	47.6	79.1	1654	48.3	79.1
4800	61.8	79.1	4877	62.5	79.1	4954	64.8	79.1
Measurement uncertainty					± 3 dB			

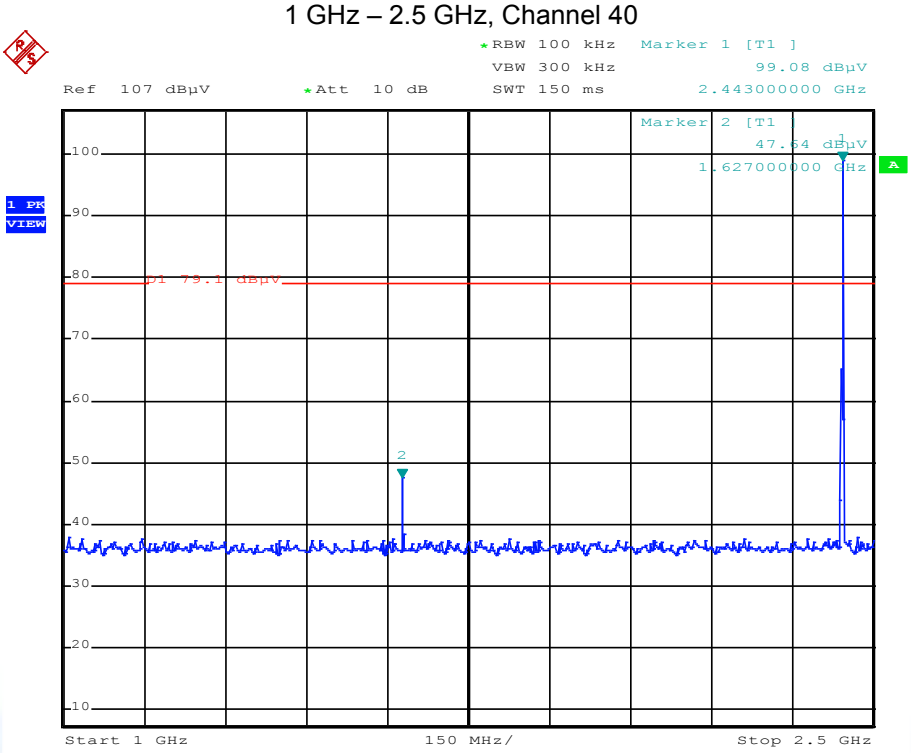
Peak-Limit according to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocols. Due to no emissions could be detected in the range f < 30 MHz, no radiated measurement were done in this range.

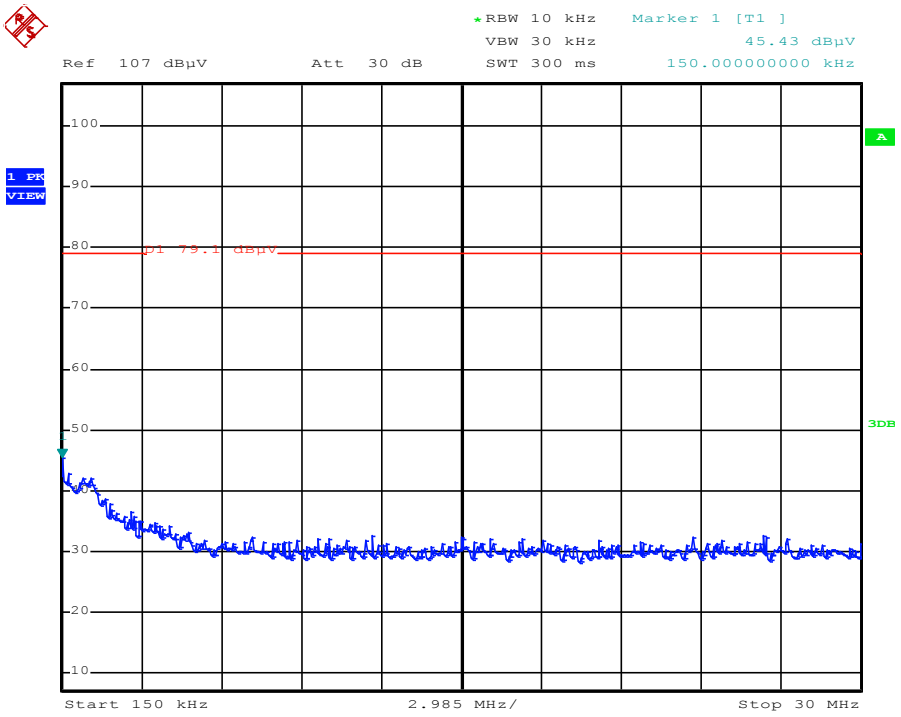
4.4.6 Test protocol

Determination of the limit level
1 GHz – 2.5 GHz, Channel 40



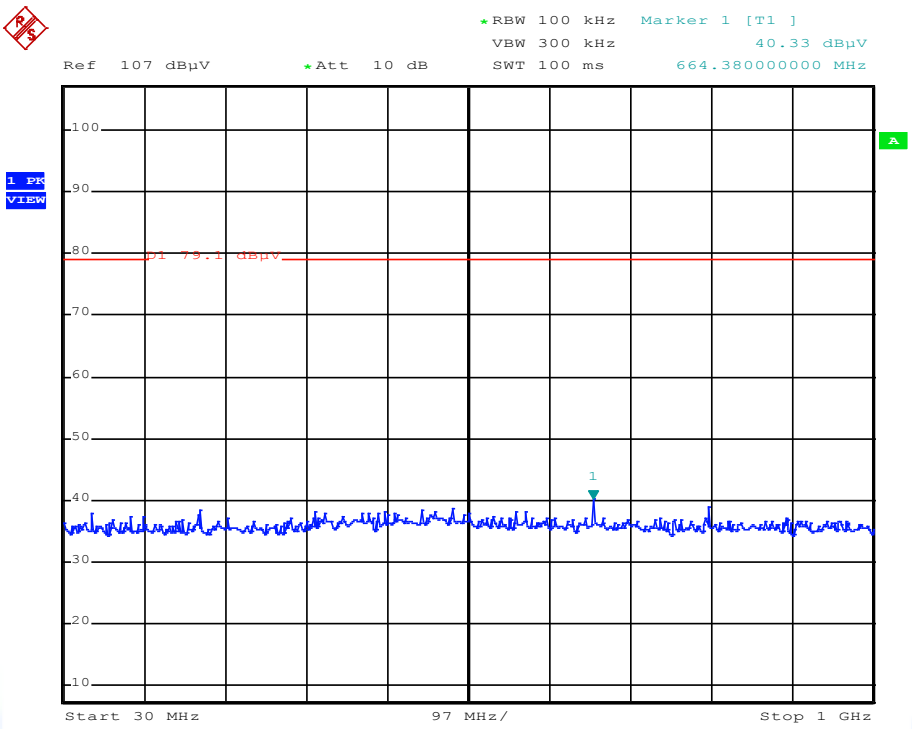
Spurious emissions conducted, DH5 packet:

150 kHz – 30 MHz, Channel 1

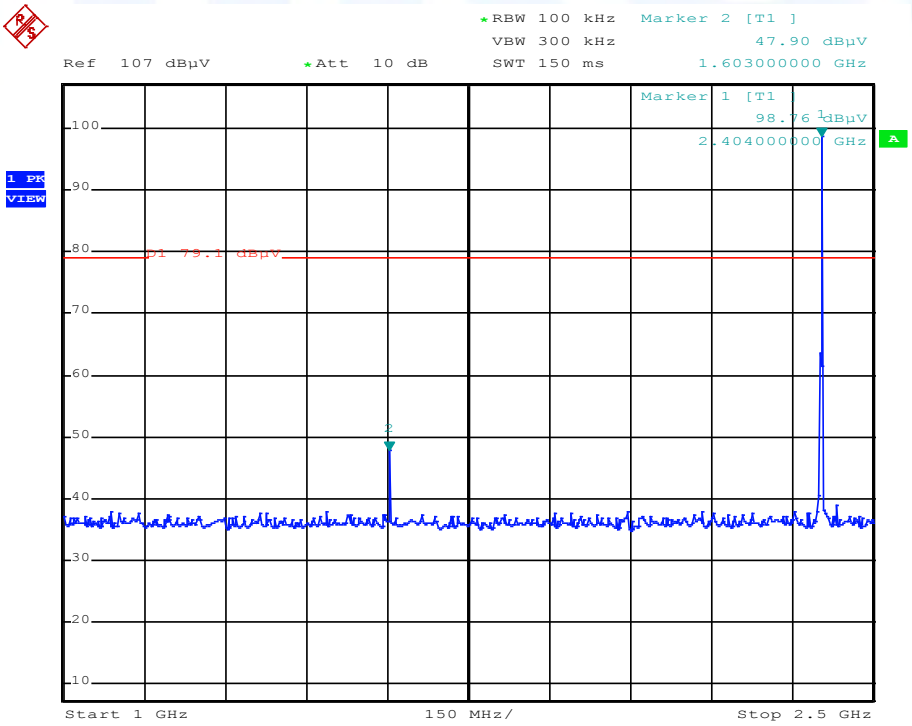


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 1

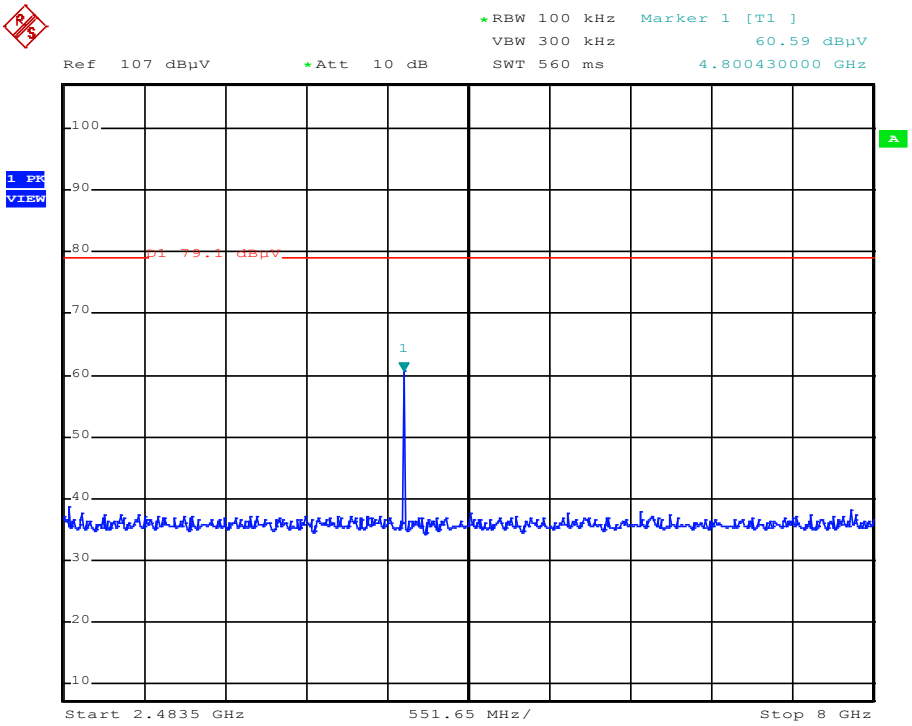


1 GHz – 2.5 GHz, Channel 1

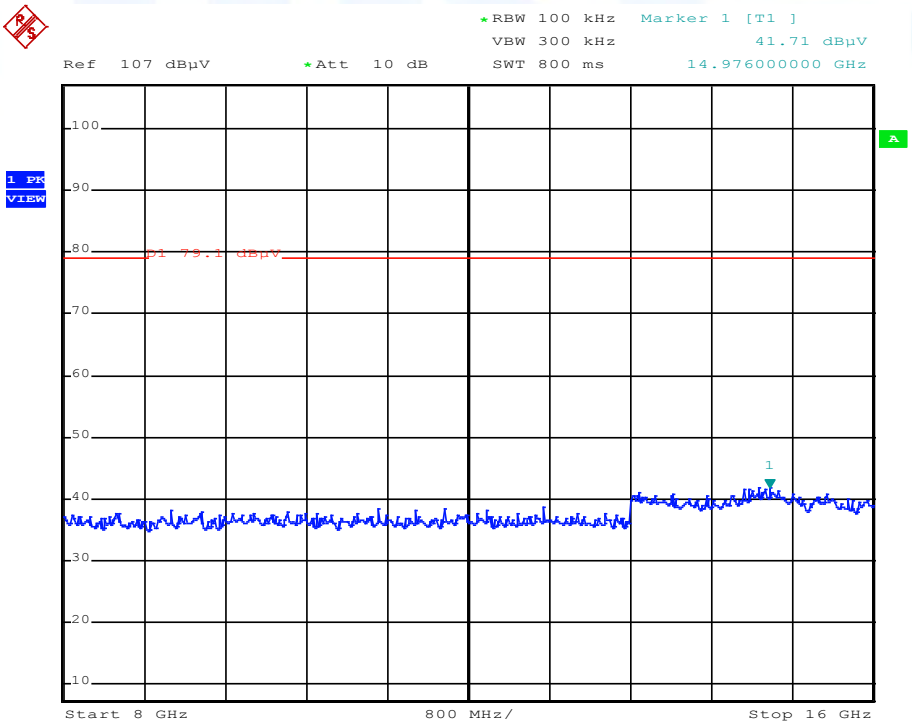


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 1

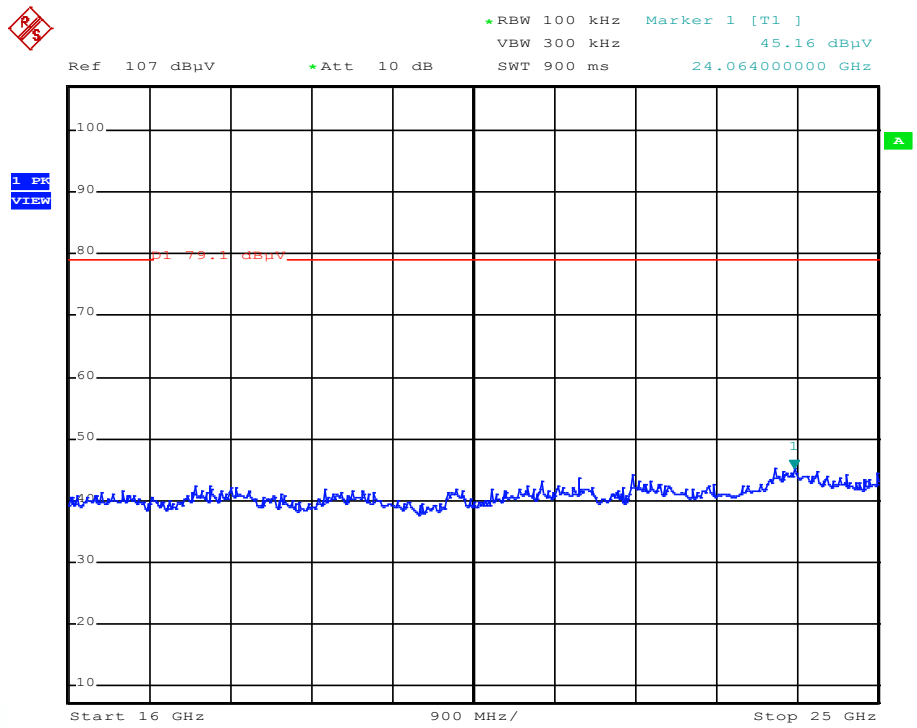


8 GHz – 16 GHz, Channel 1



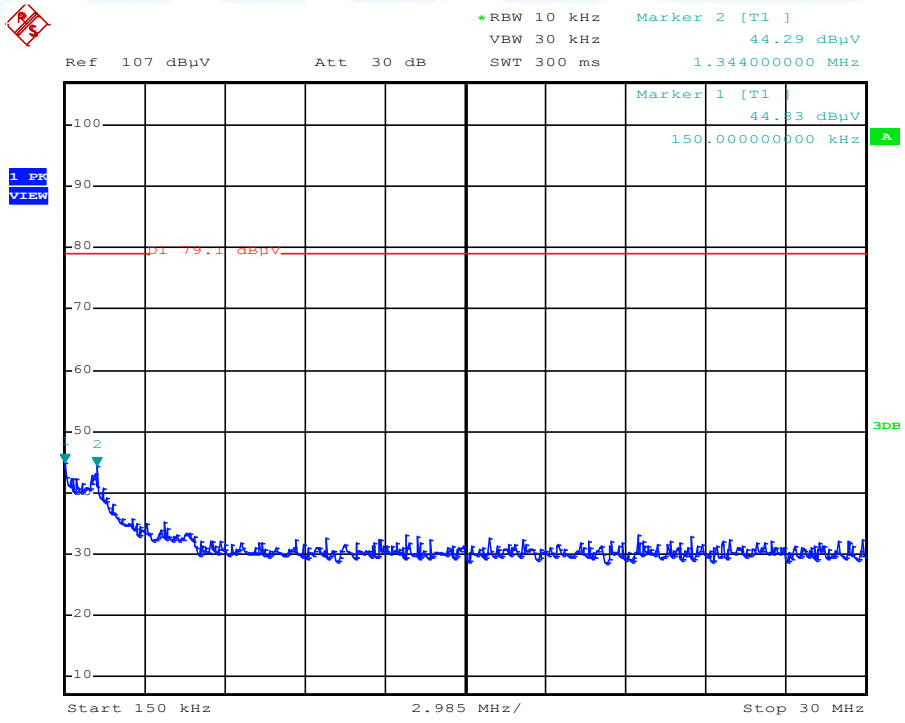
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 1



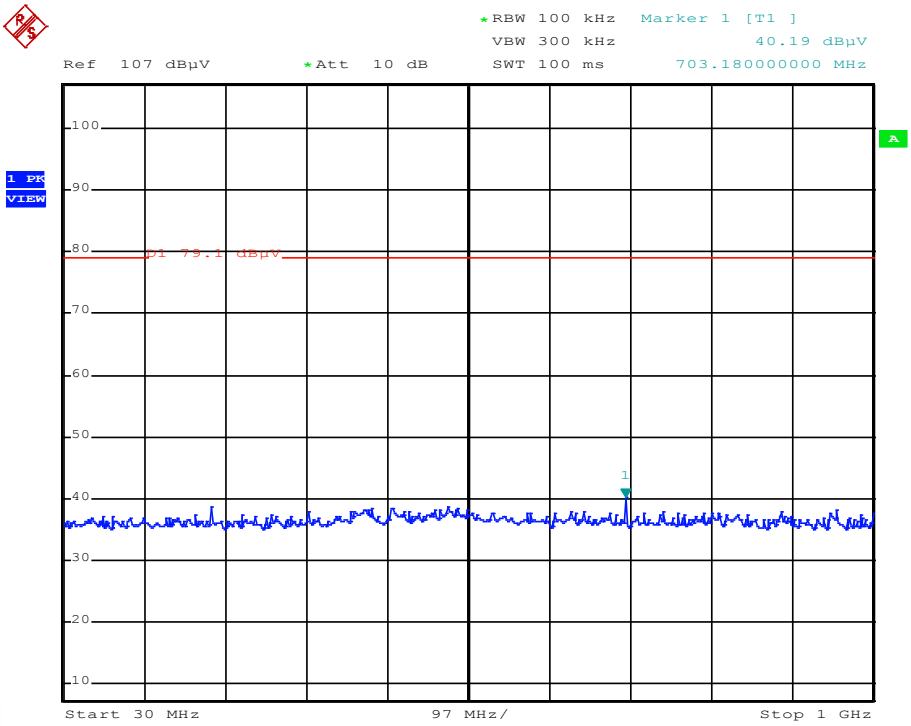
Spurious emissions conducted, DH5 packet:

150 kHz – 30 MHz, Channel 40

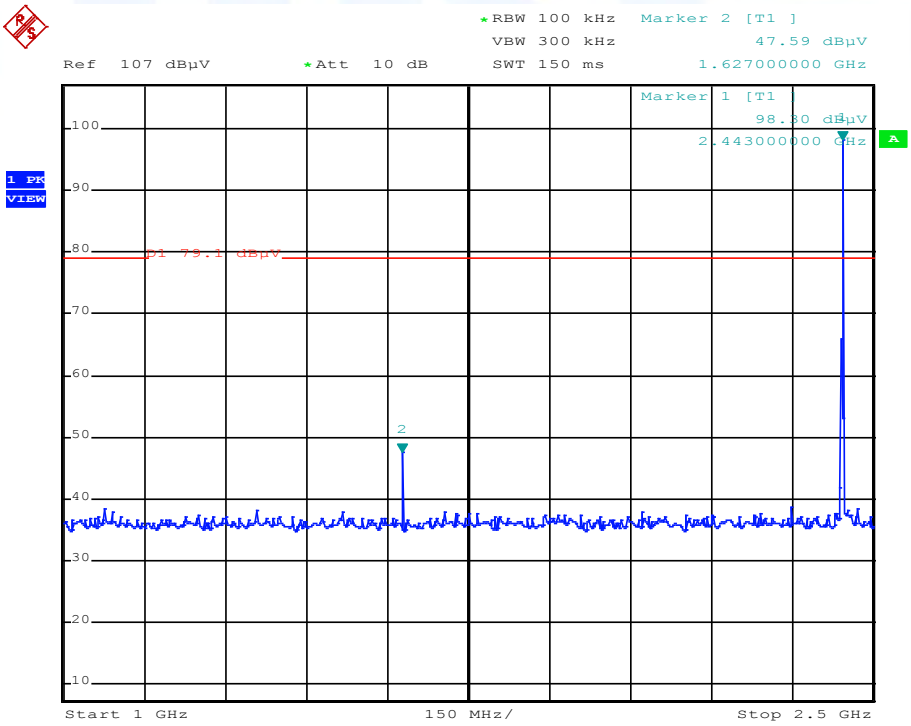


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 40

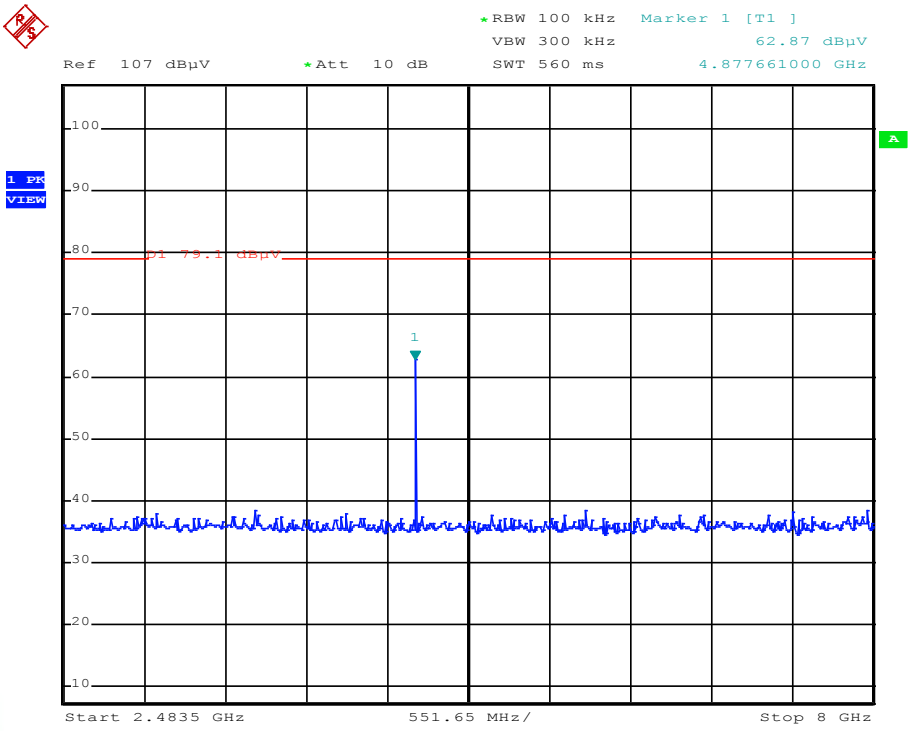


1 GHz – 2.5 GHz, Channel 40

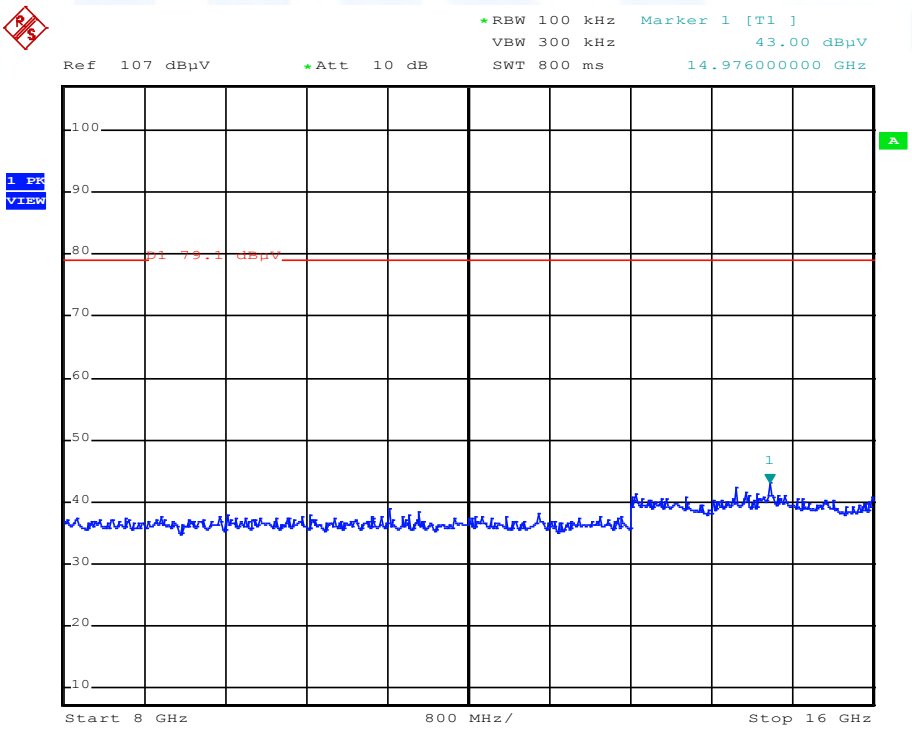


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 40

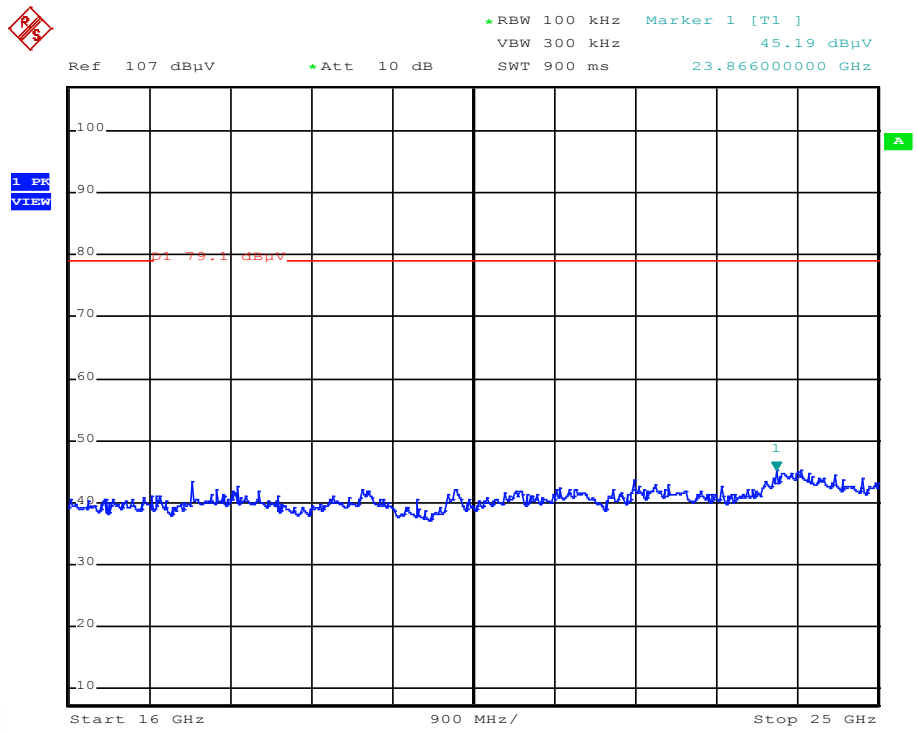


8 GHz – 16 GHz, Channel 40



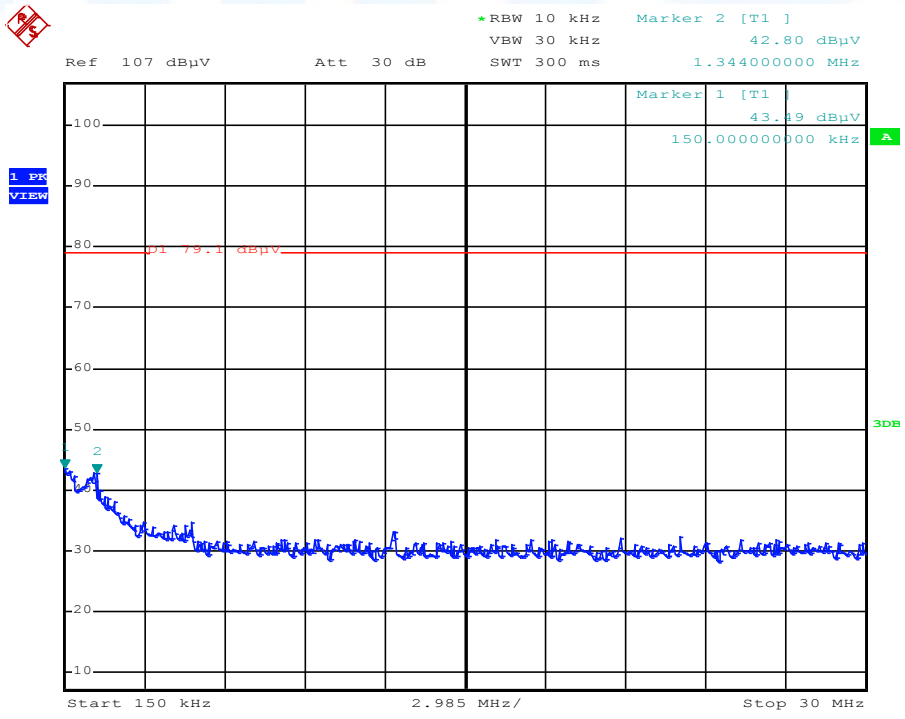
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 40



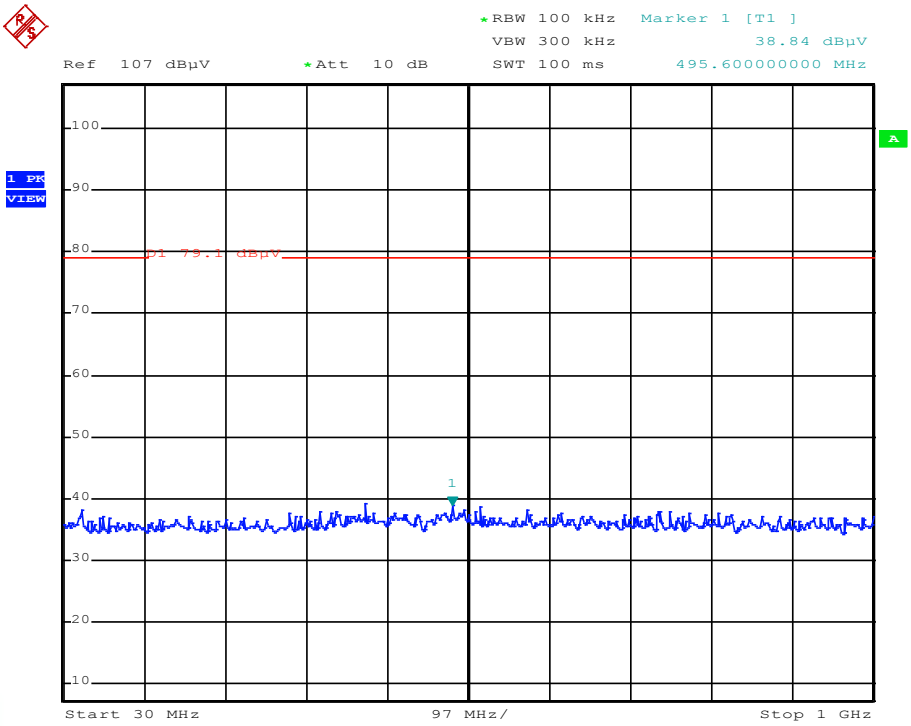
Spurious emissions conducted, DH5 packet:

150 kHz – 30 MHz, Channel 79

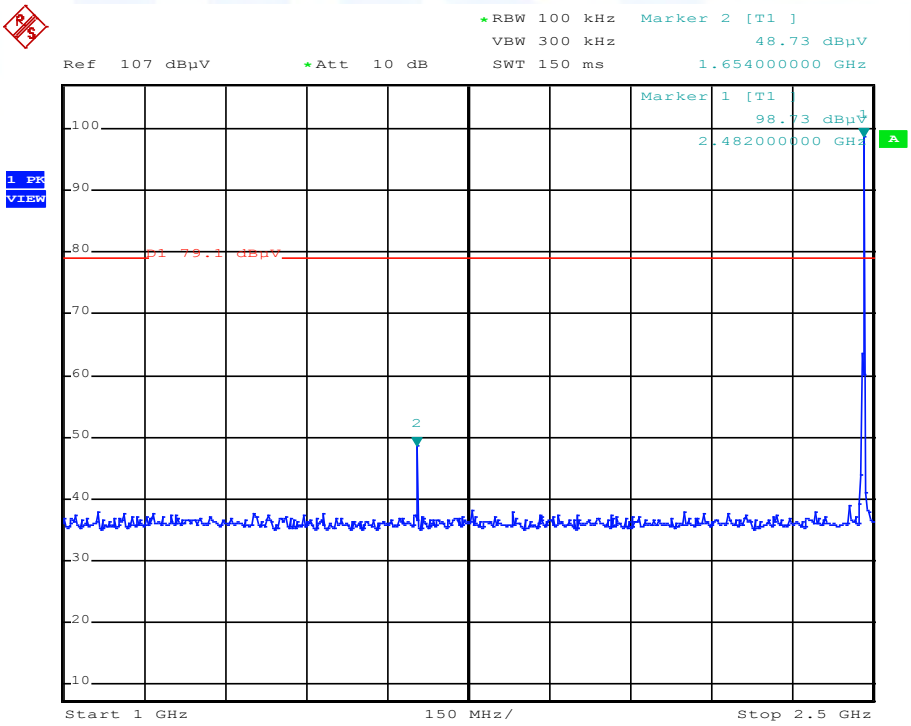


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 79

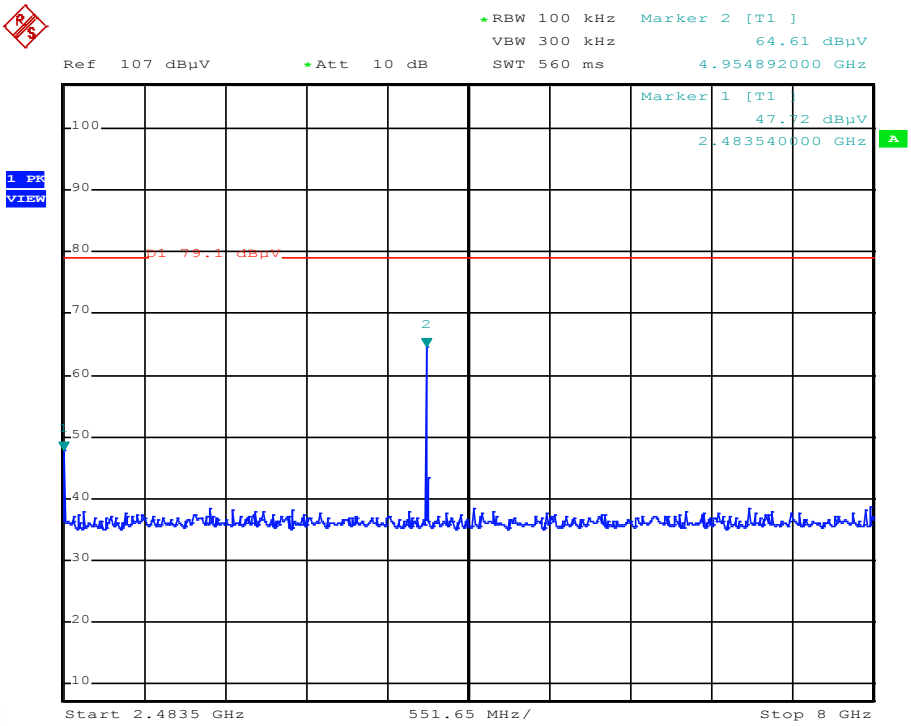


1 GHz – 2.5 GHz, Channel 79

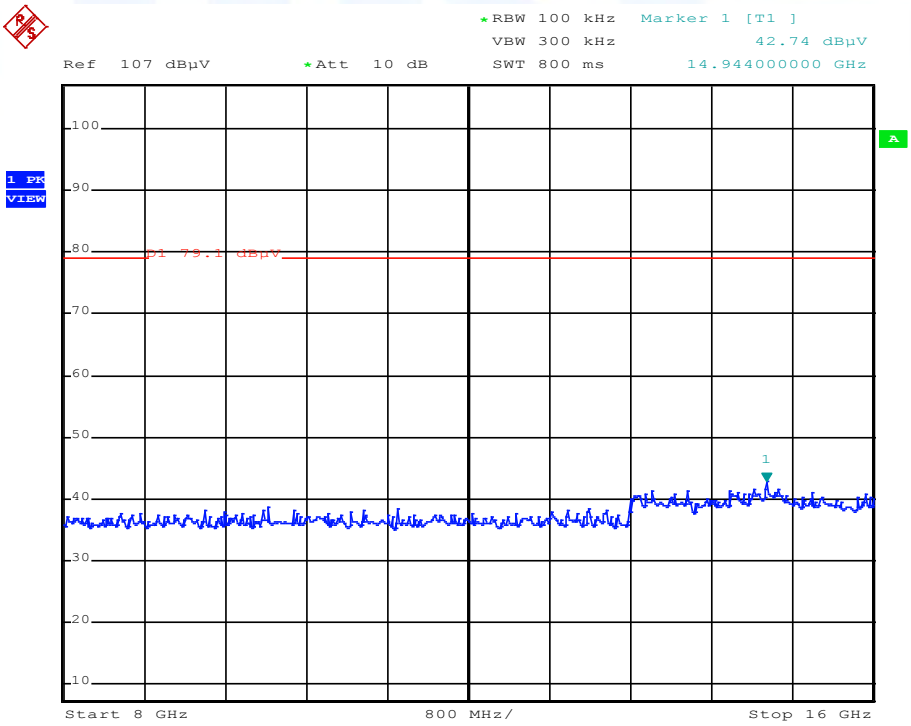


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 79

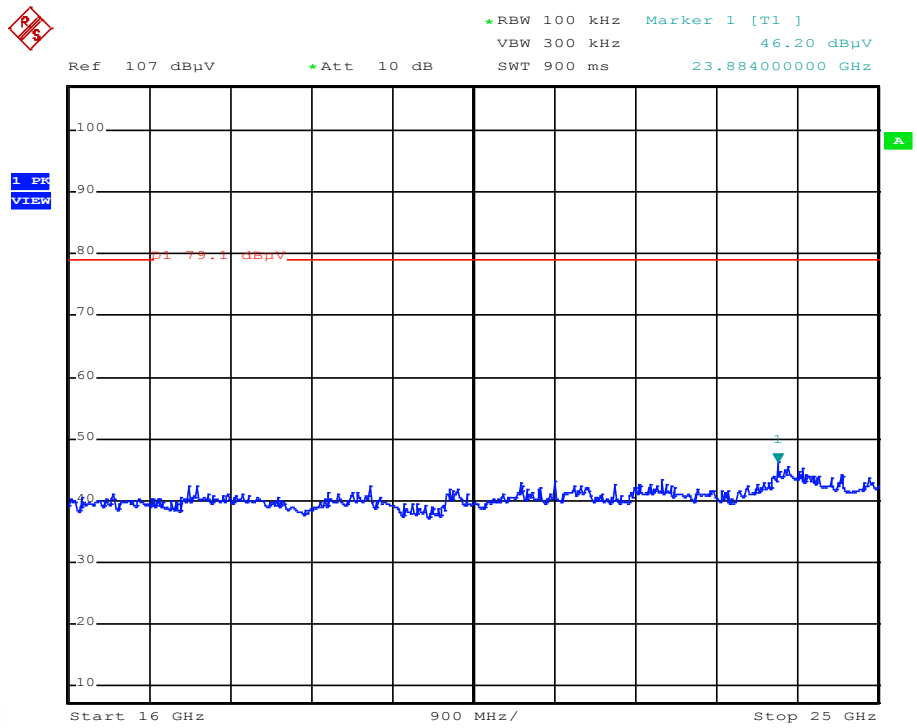


8 GHz – 16 GHz, Channel 79



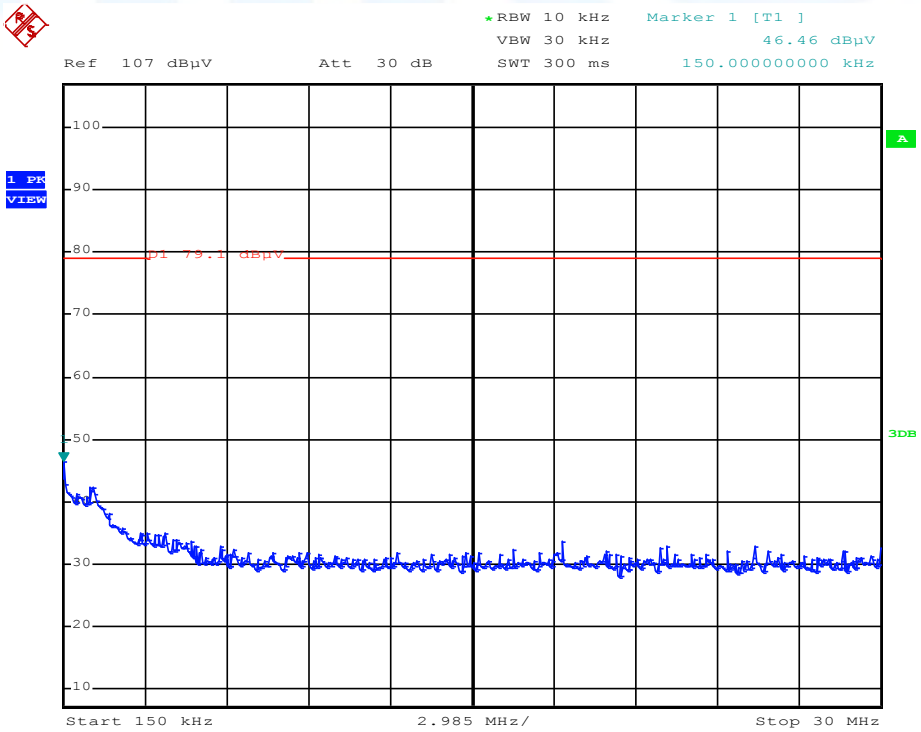
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 79



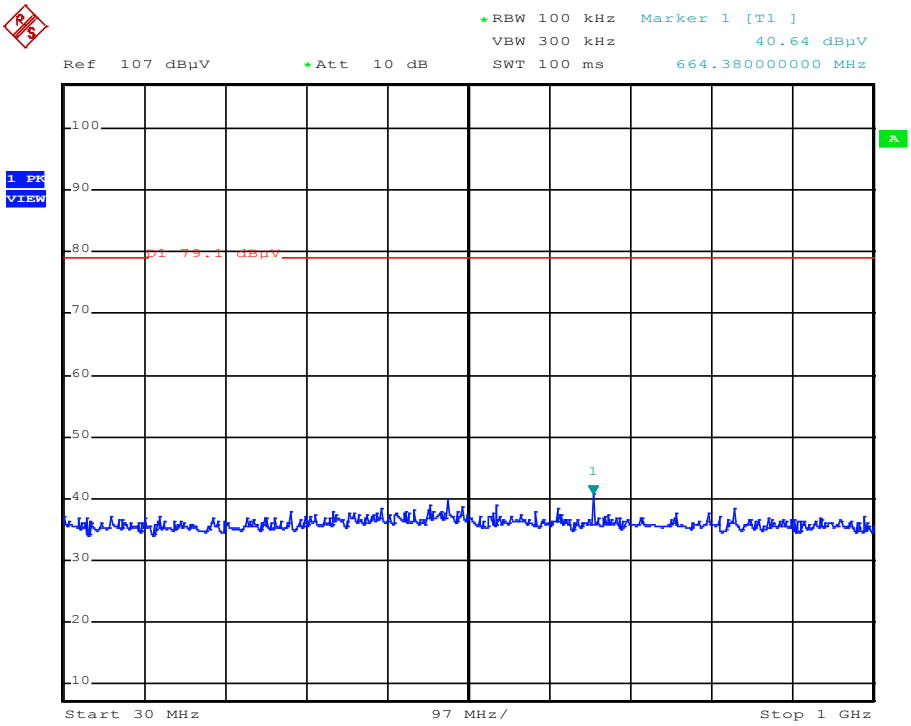
Spurious emissions conducted, 2-DH5 packet:

150 kHz – 30 MHz, Channel 1

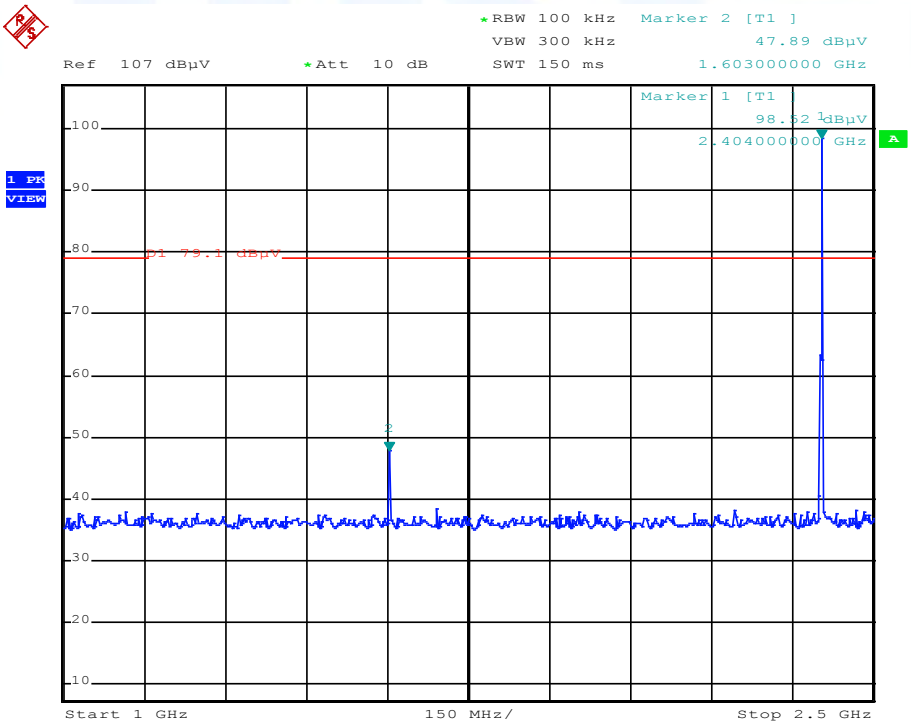


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 1

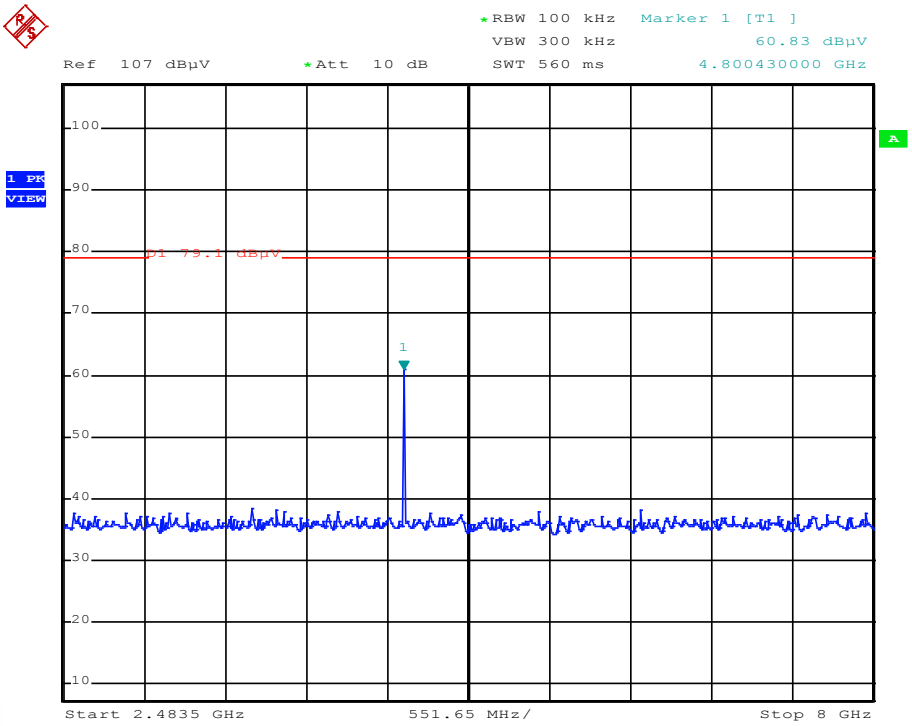


1 GHz – 2.5 GHz, Channel 1

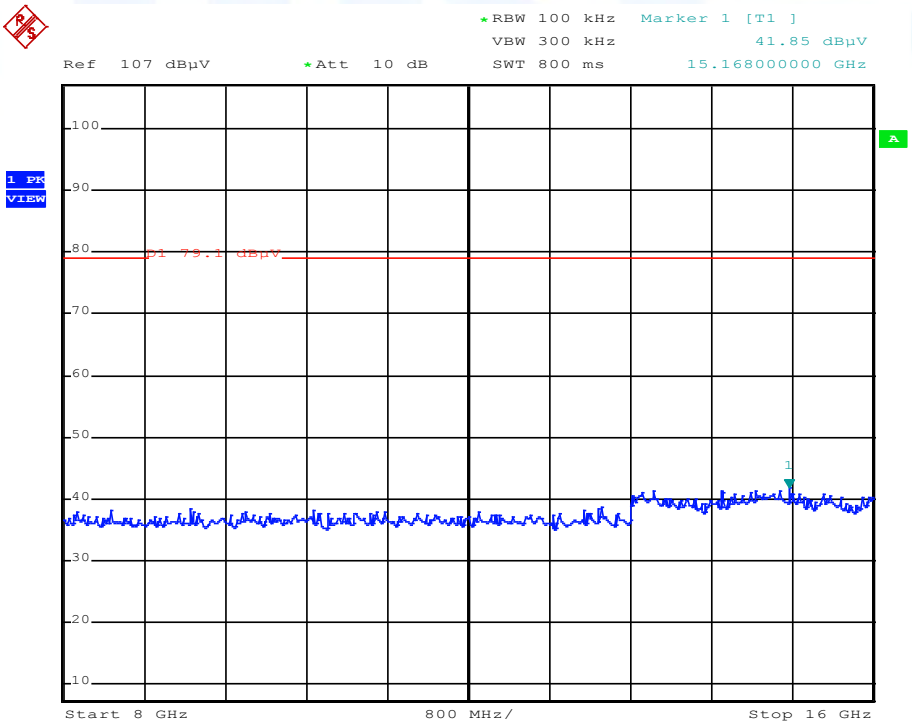


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 1

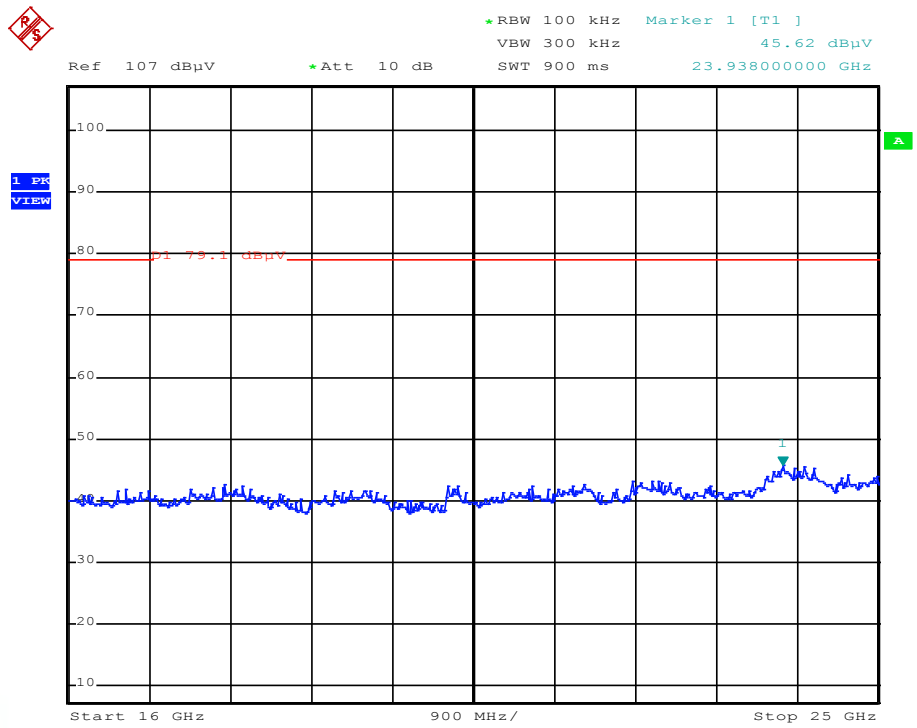


8 GHz – 16 GHz, Channel 1



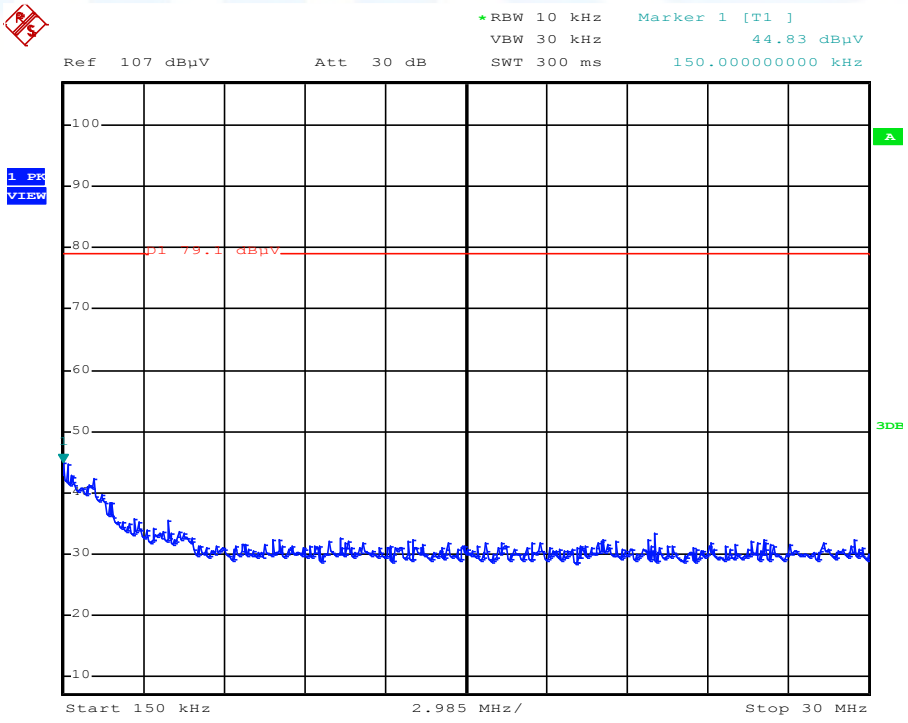
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 1



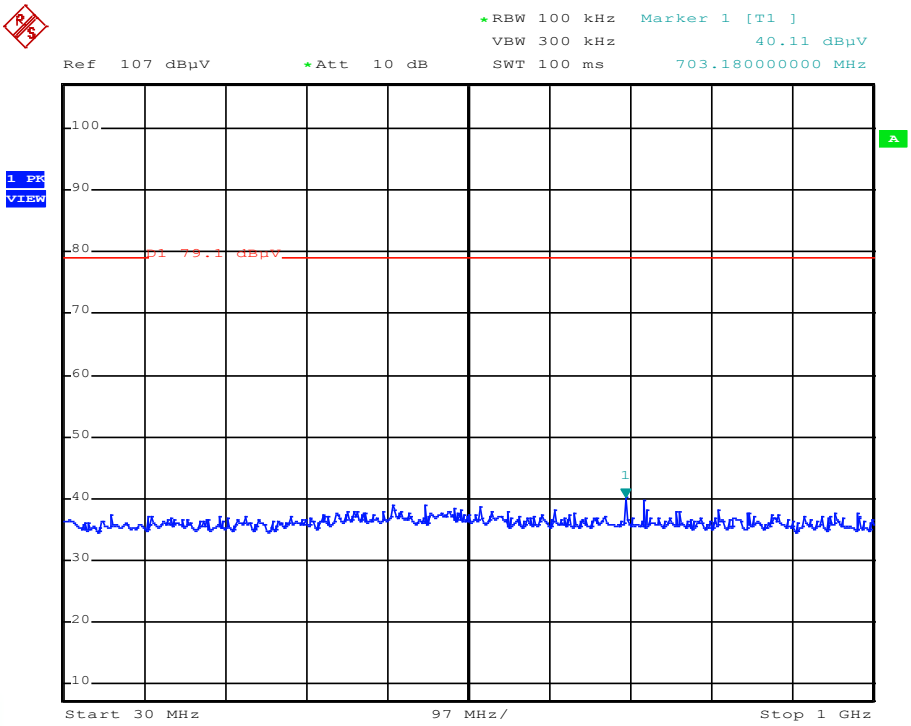
Spurious emissions conducted, 2-DH5 packet:

150 kHz – 30 MHz, Channel 40

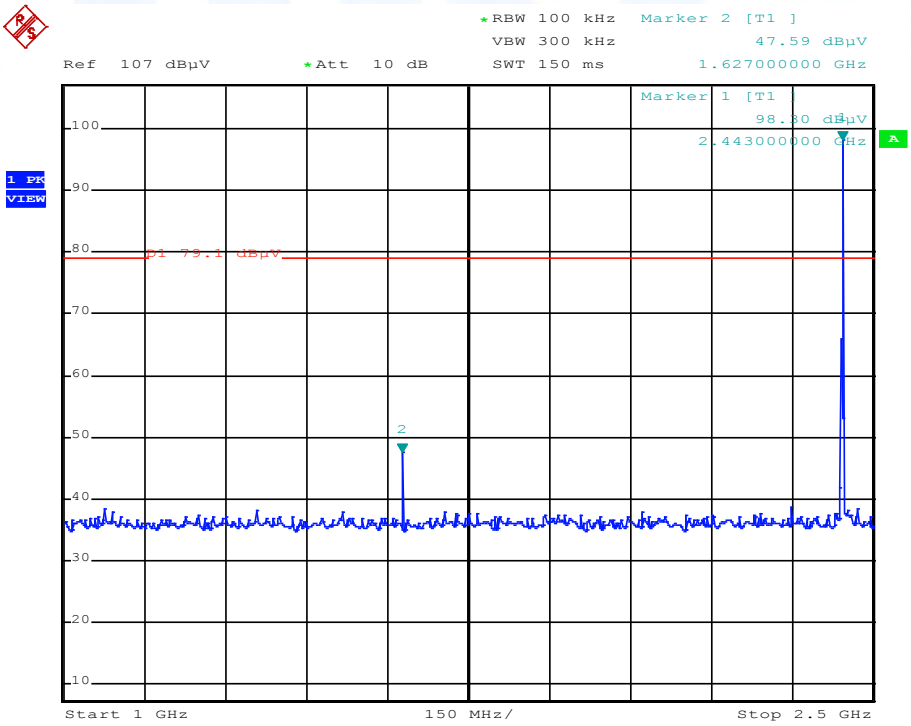


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 40

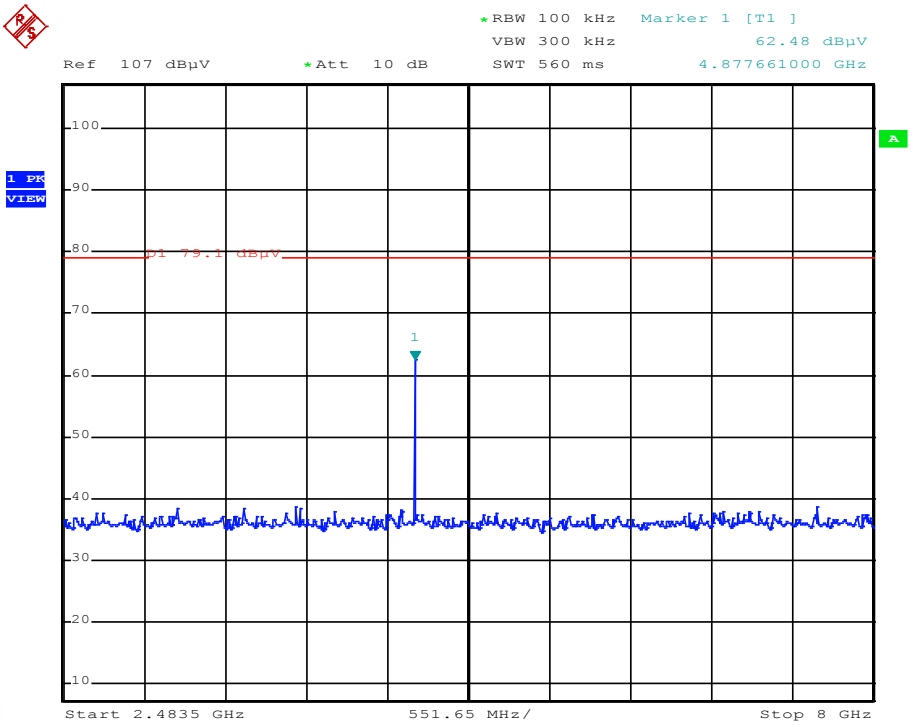


1 GHz – 2.5 GHz, Channel 40

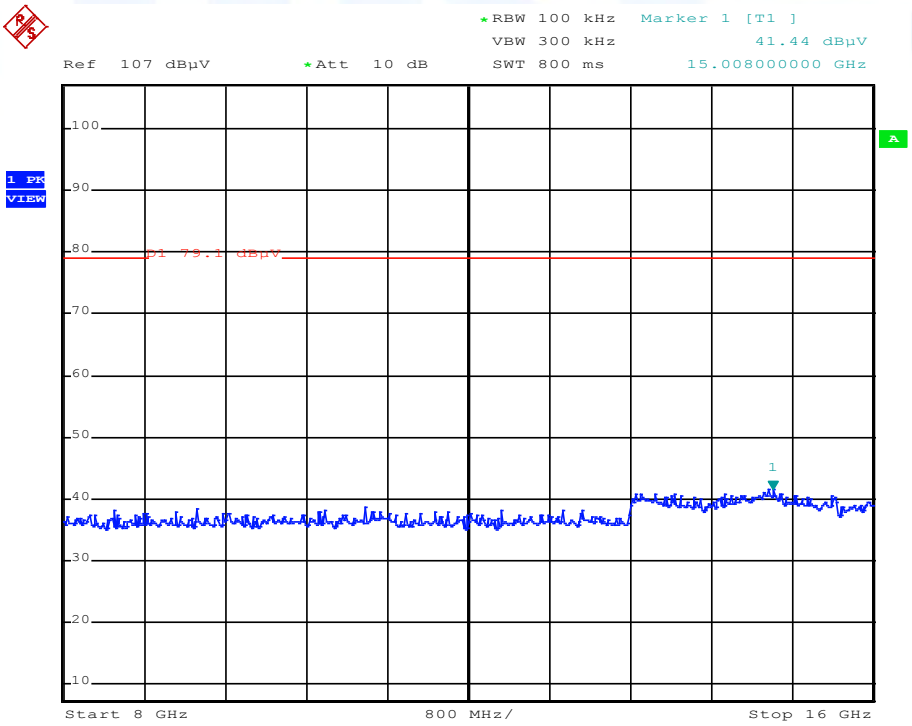


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 40

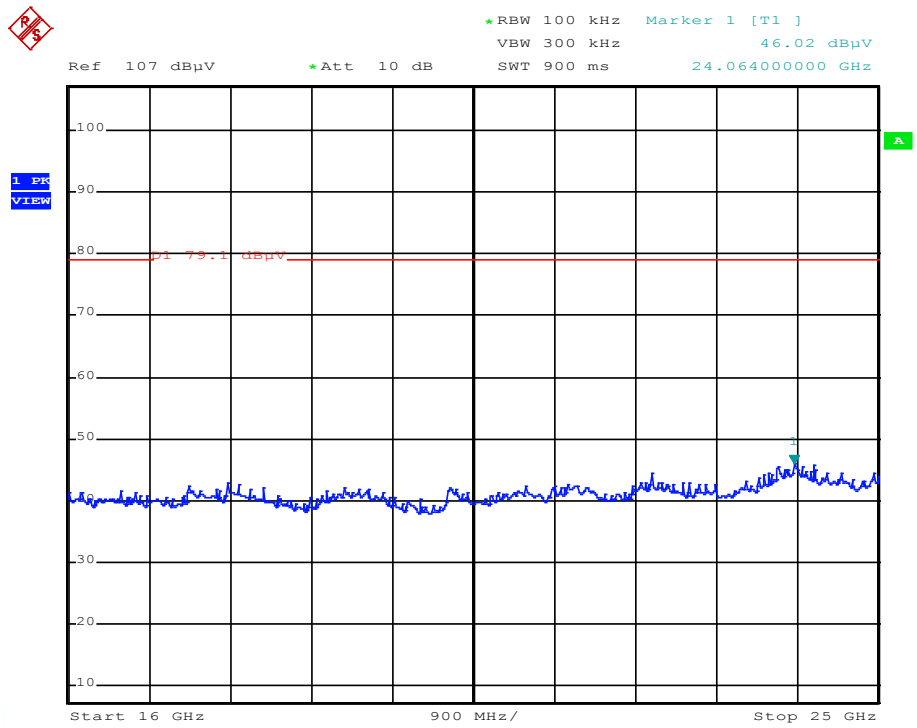


8 GHz – 16 GHz, Channel 40



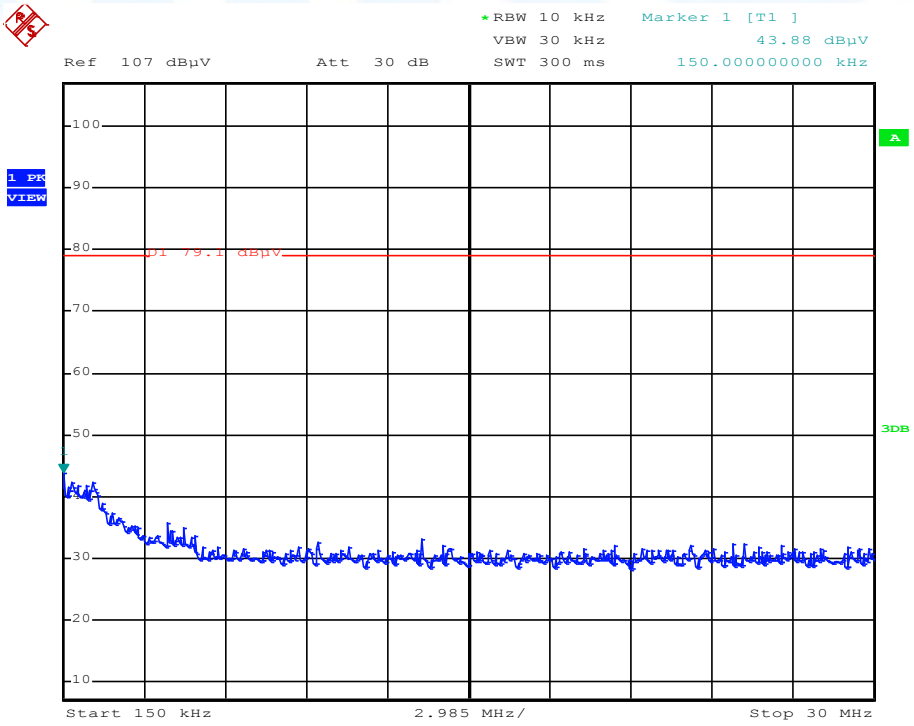
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 40



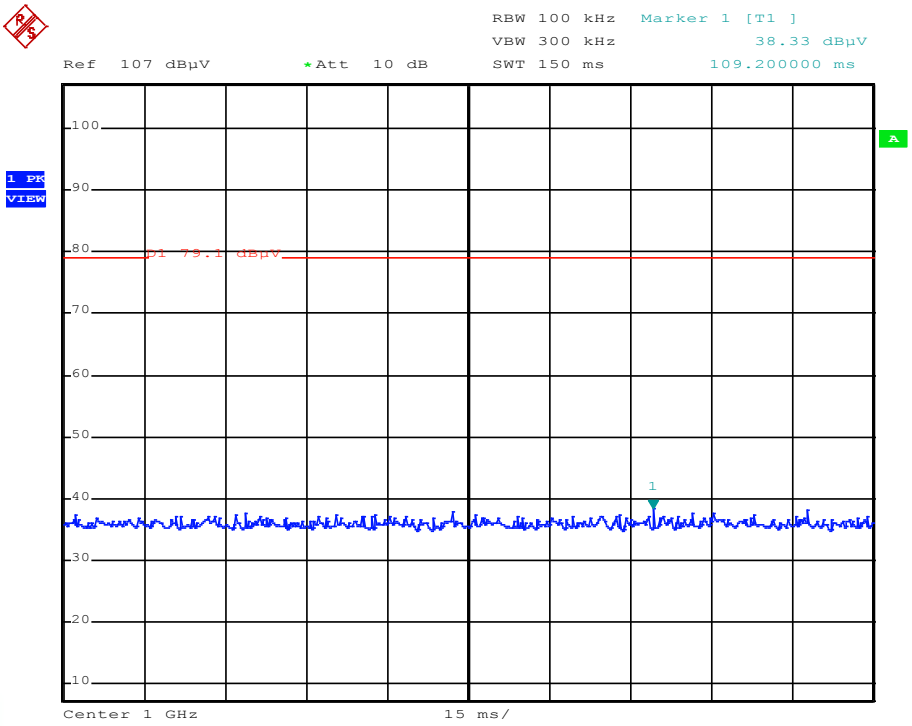
Spurious emissions conducted, 2-DH5 packet:

150 kHz – 30 MHz, Channel 79

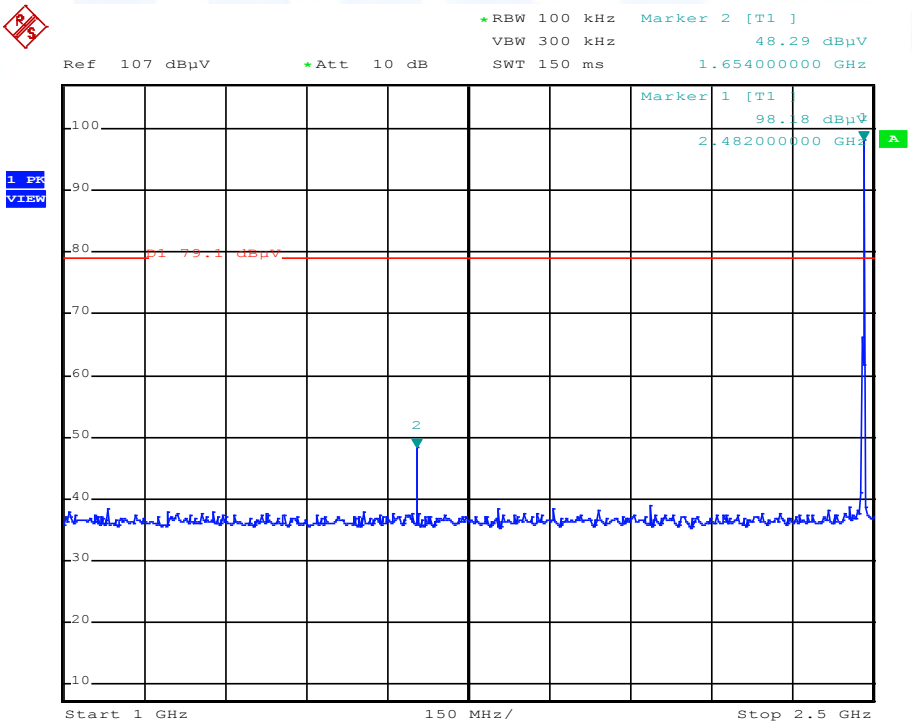


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 79

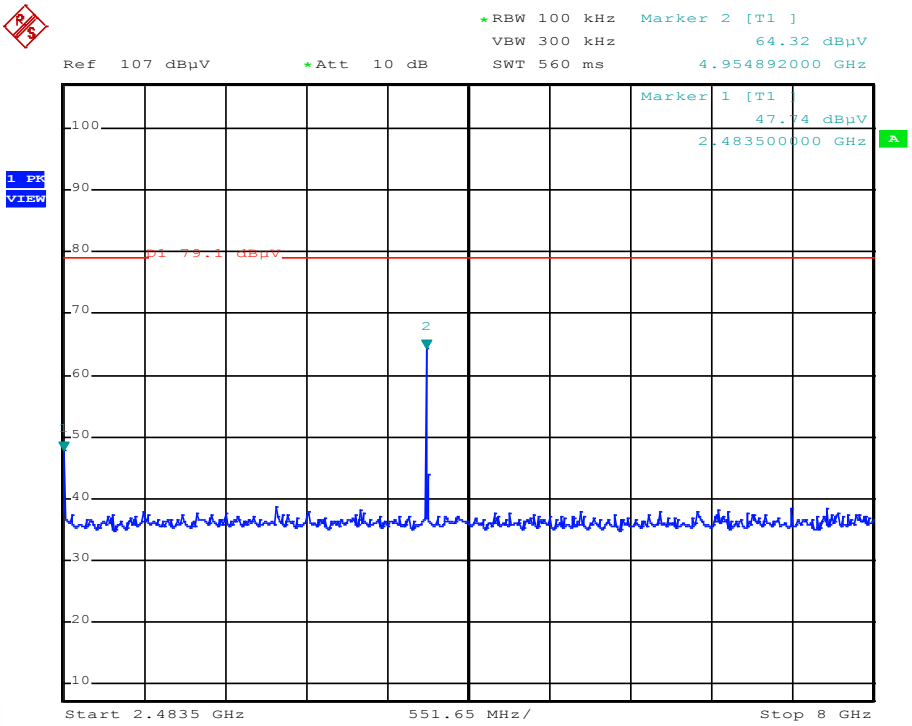


1 GHz – 2.5 GHz, Channel 79

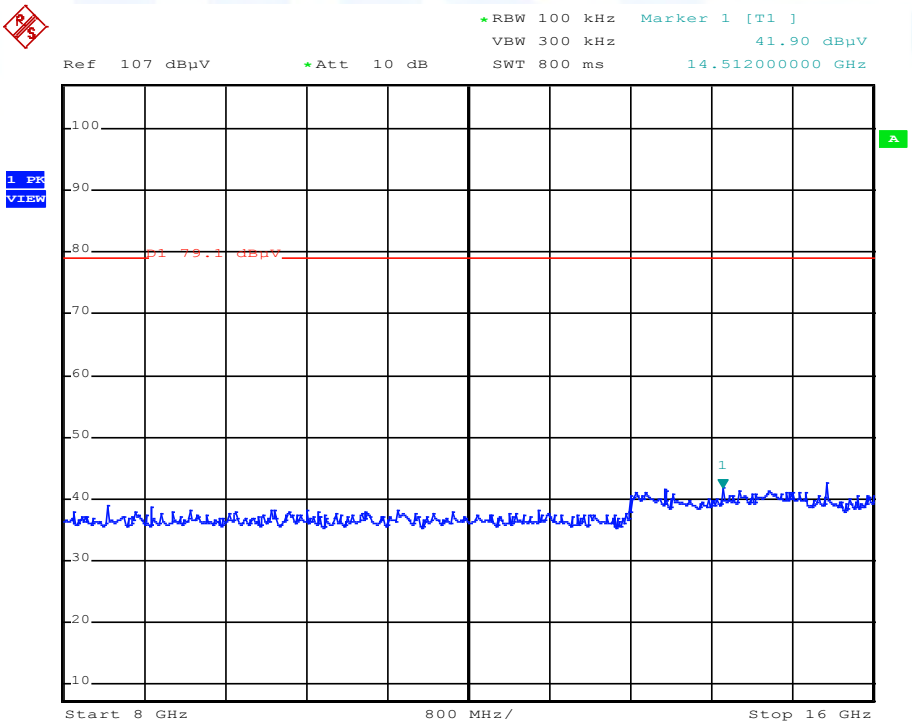


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 79

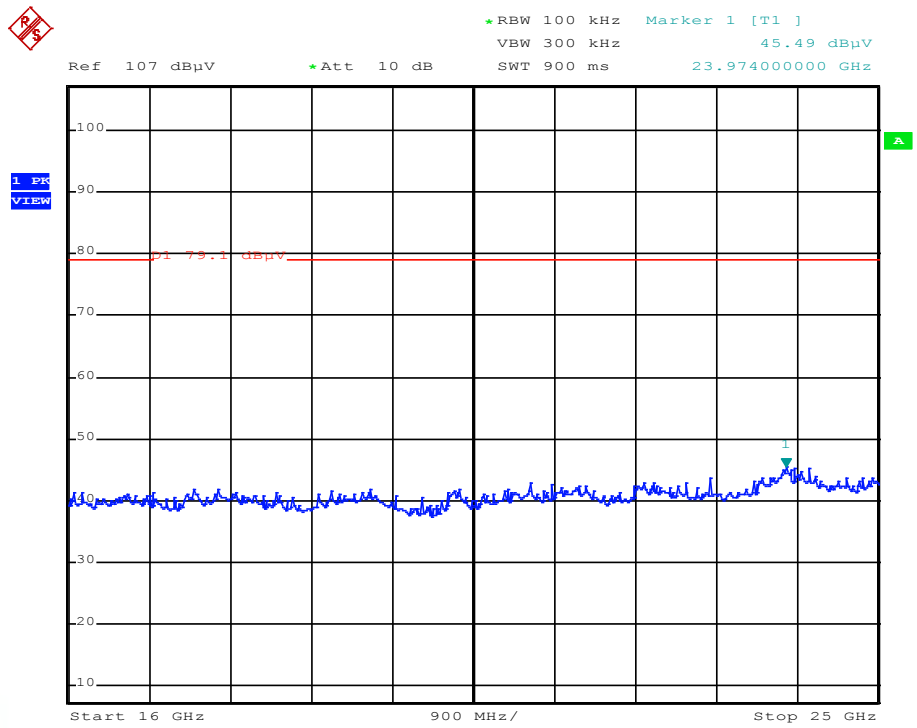


8 GHz – 16 GHz, Channel 79



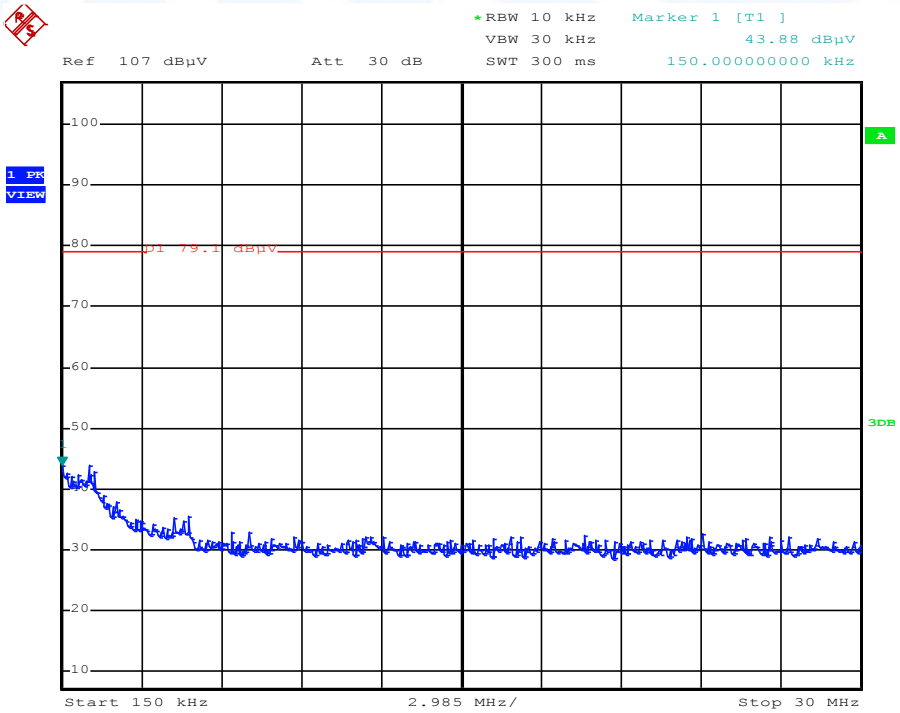
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 79



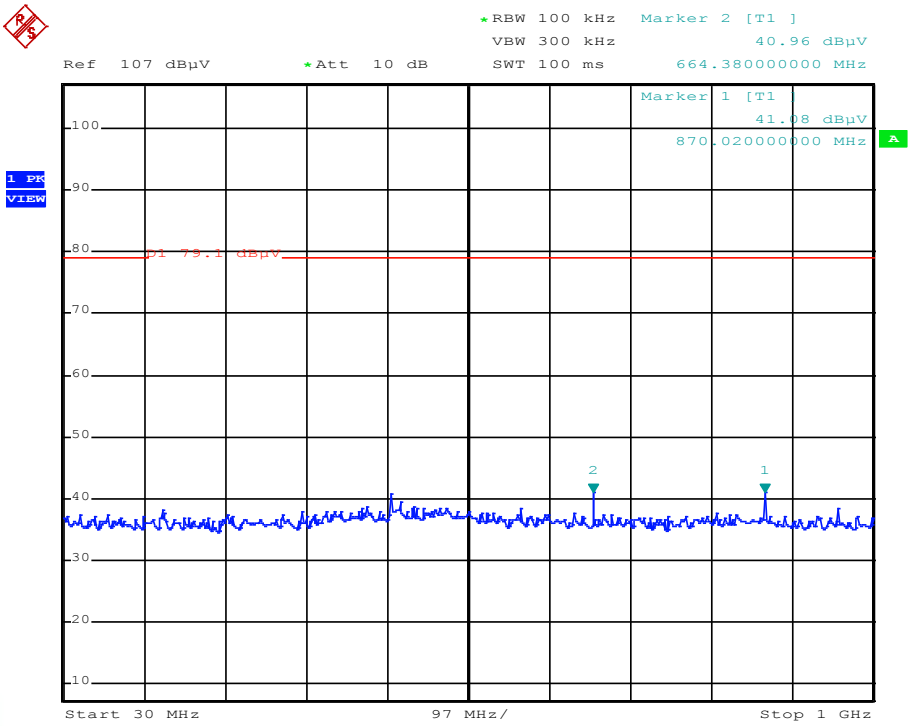
Spurious emissions conducted, 3-DH5 packet:

150 kHz – 30 MHz, Channel 1

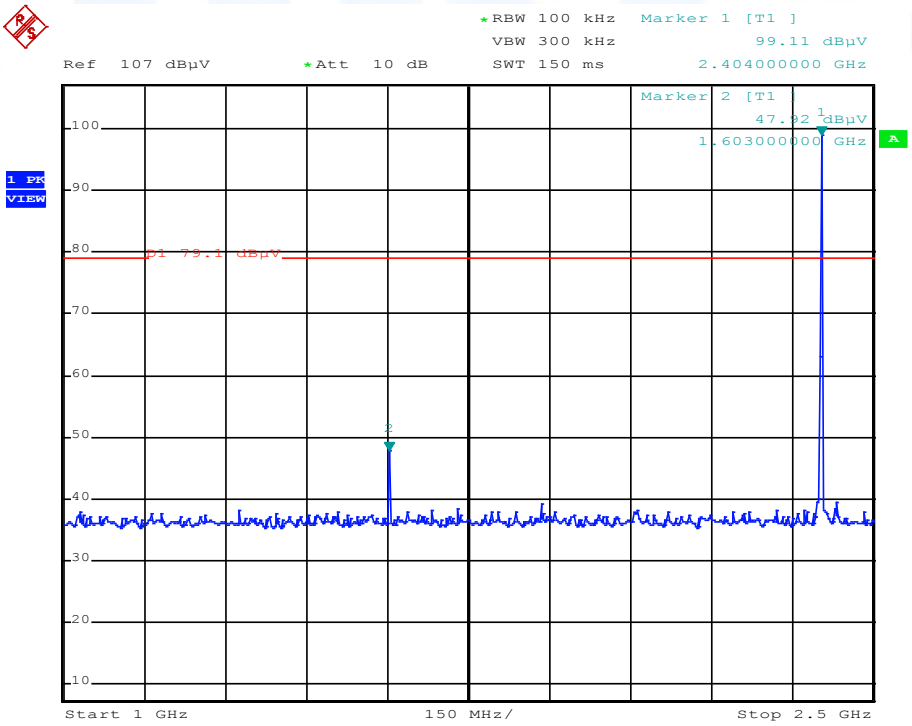


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 1

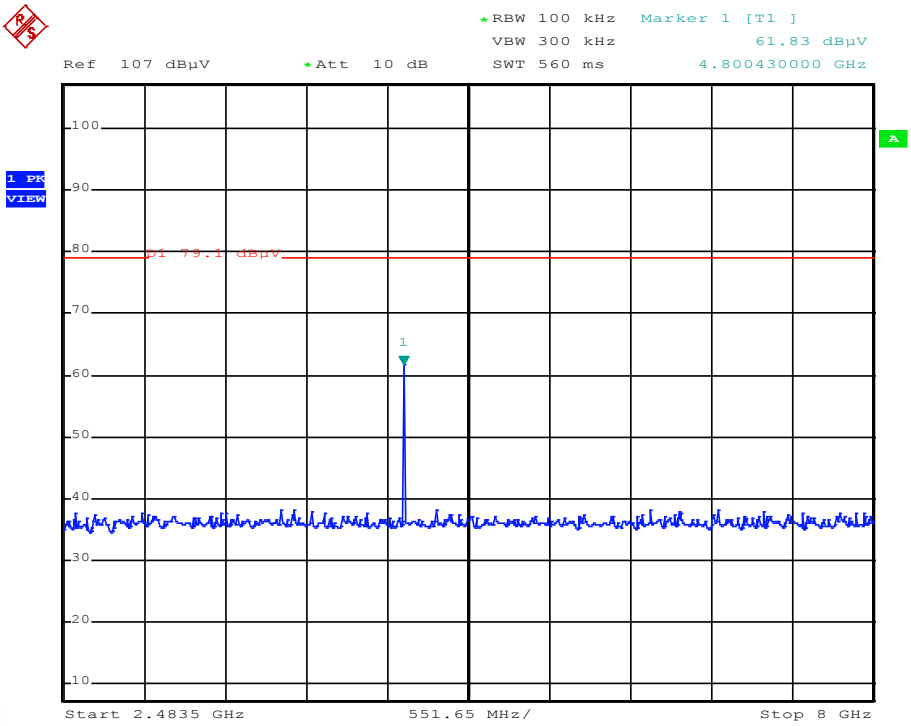


1 GHz – 2.5 GHz, Channel 1

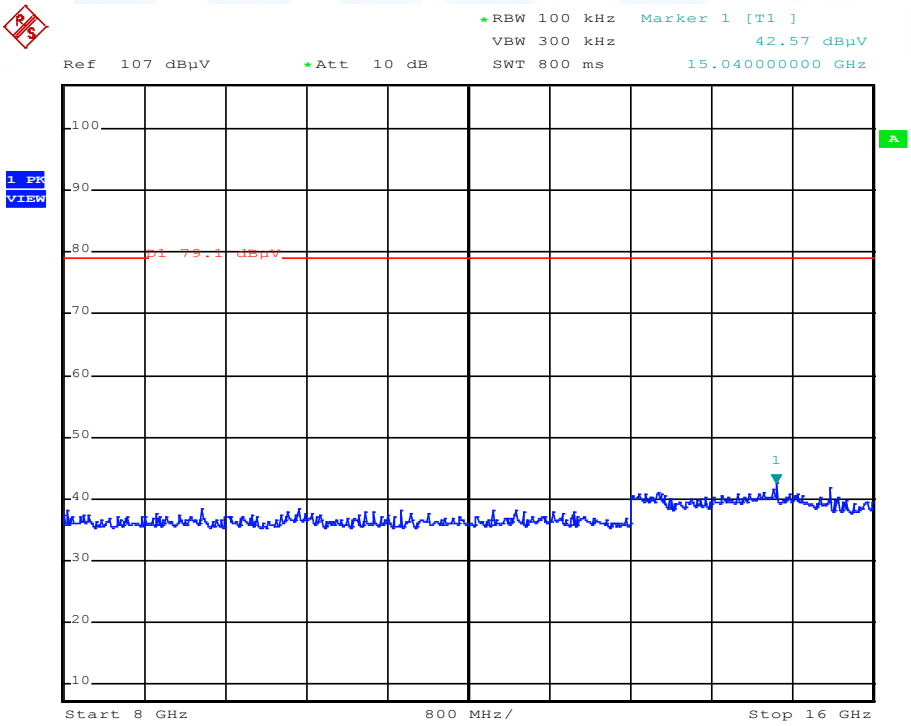


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 1

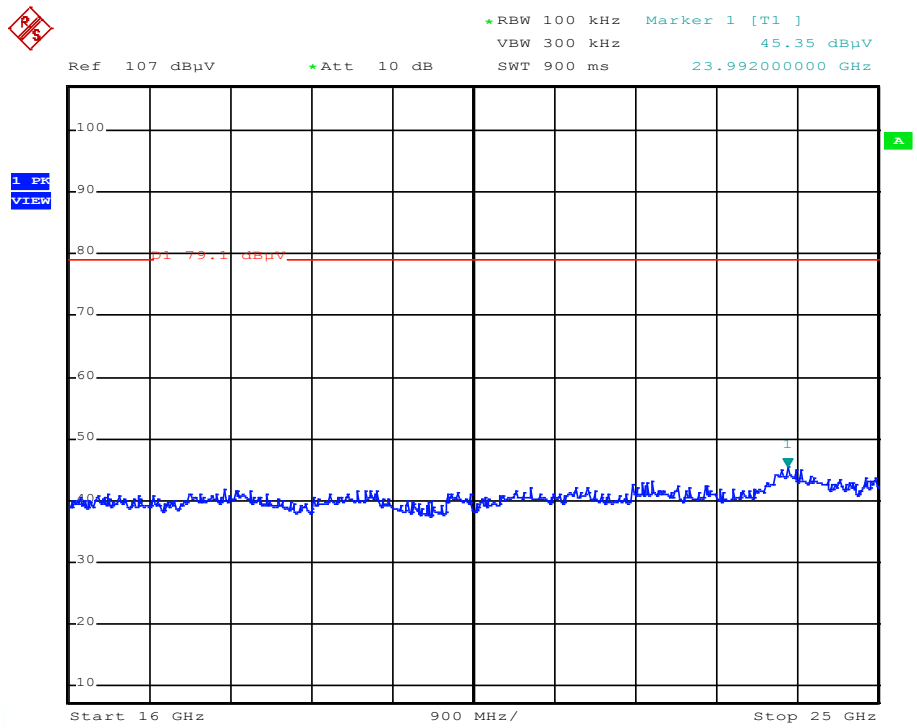


8 GHz – 16 GHz, Channel 1



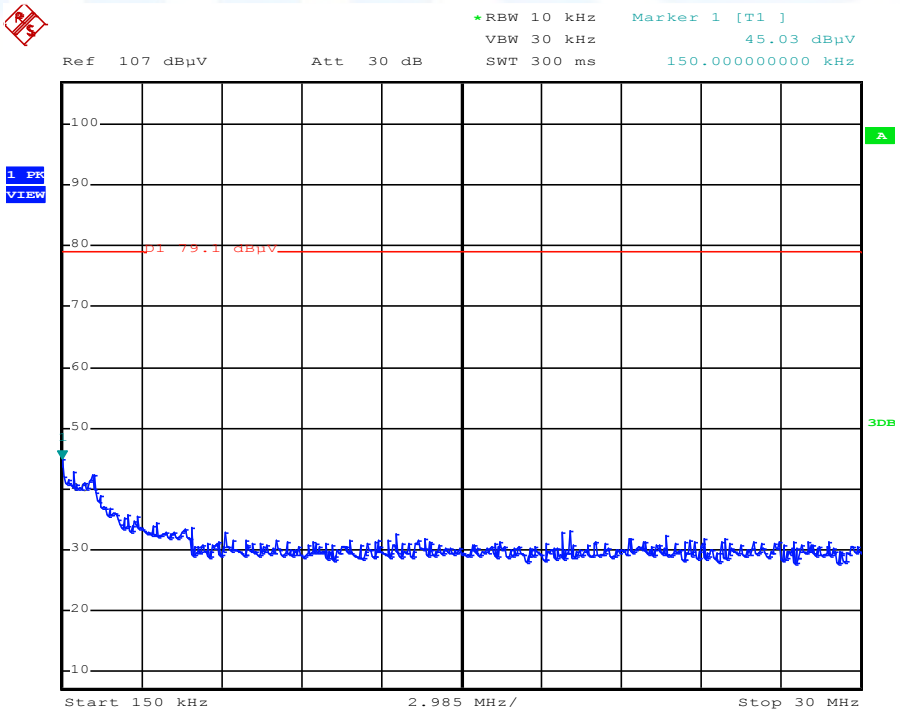
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 1



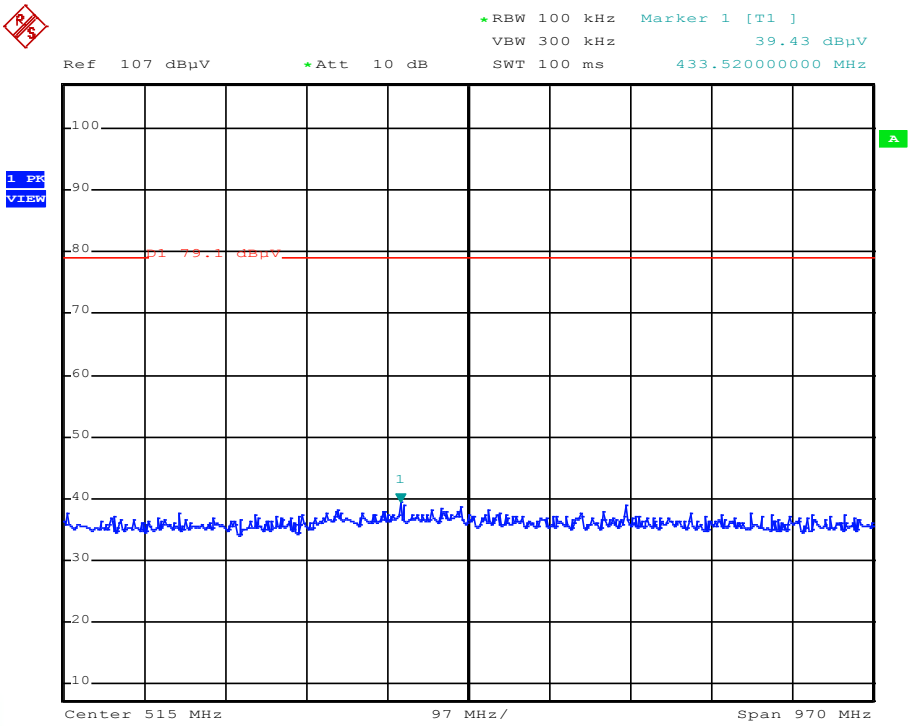
Spurious emissions conducted, 3-DH5 packet:

150 kHz – 30 MHz, Channel 40

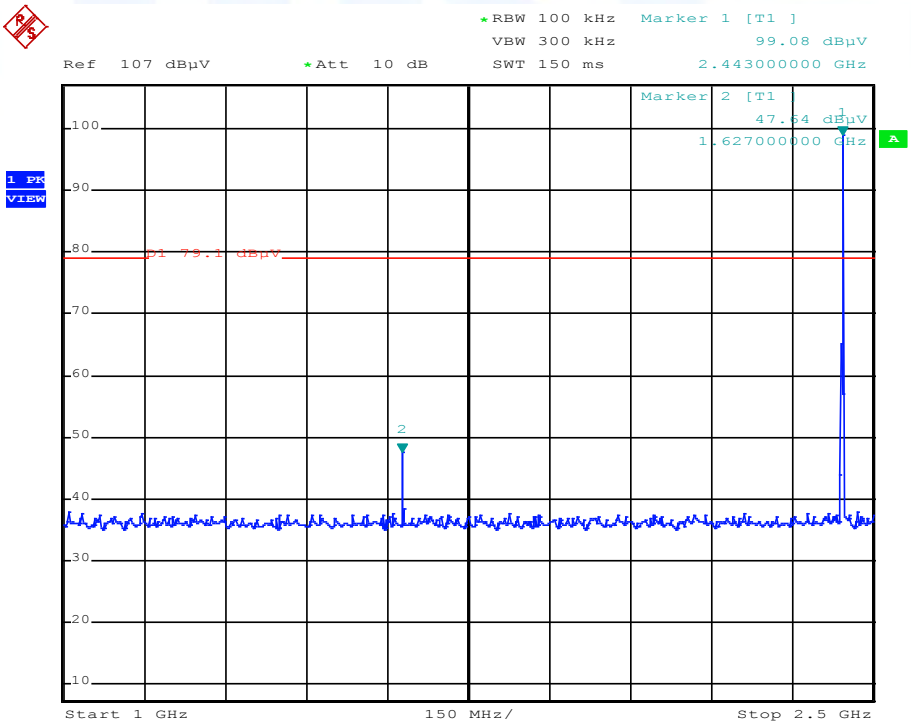


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 40

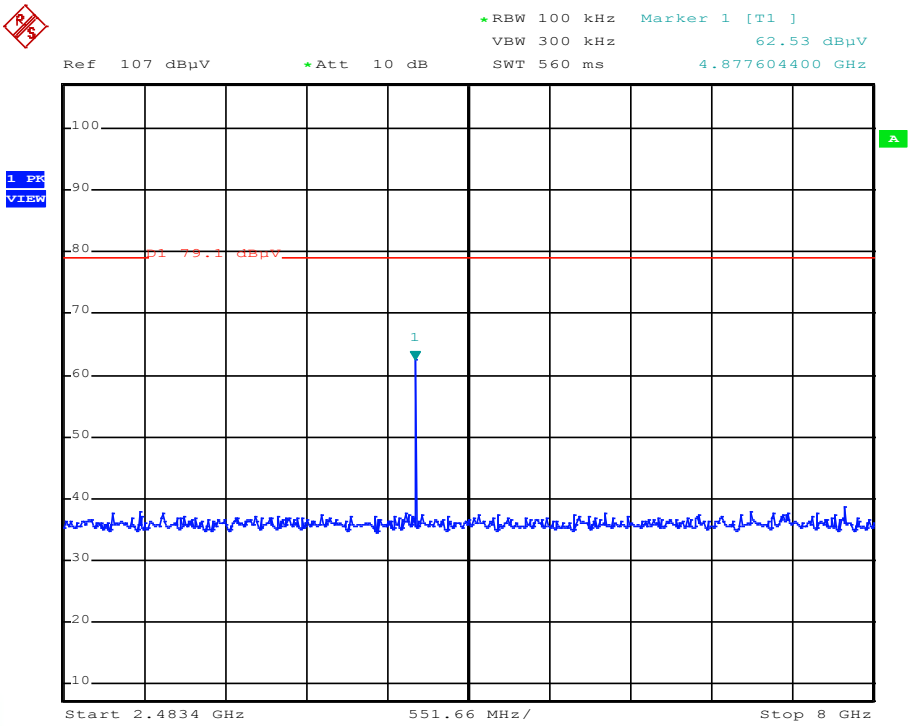


1 GHz – 2.5 GHz, Channel 40

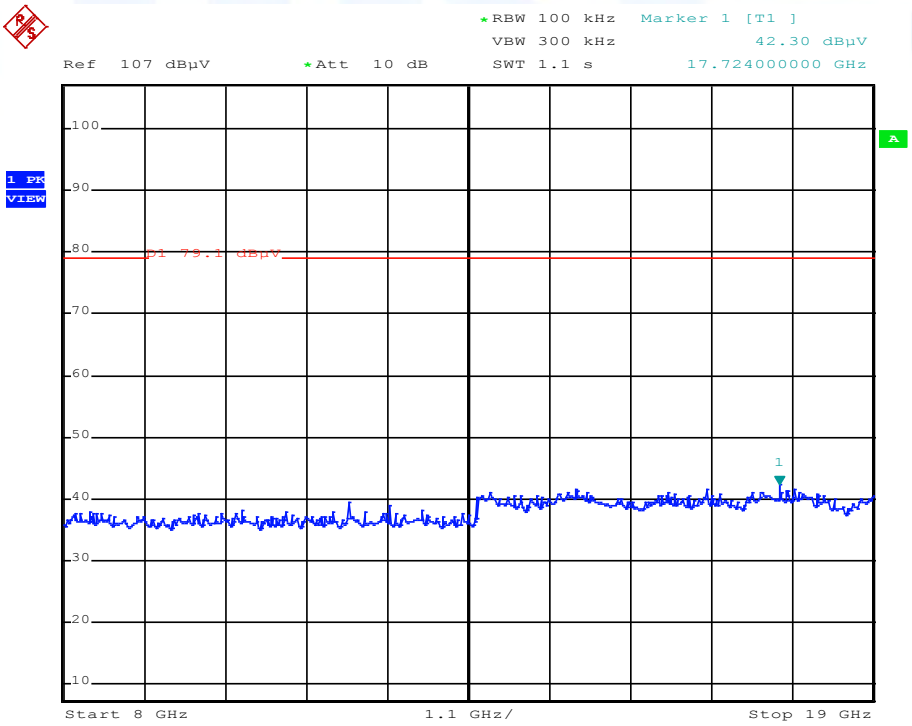


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 40

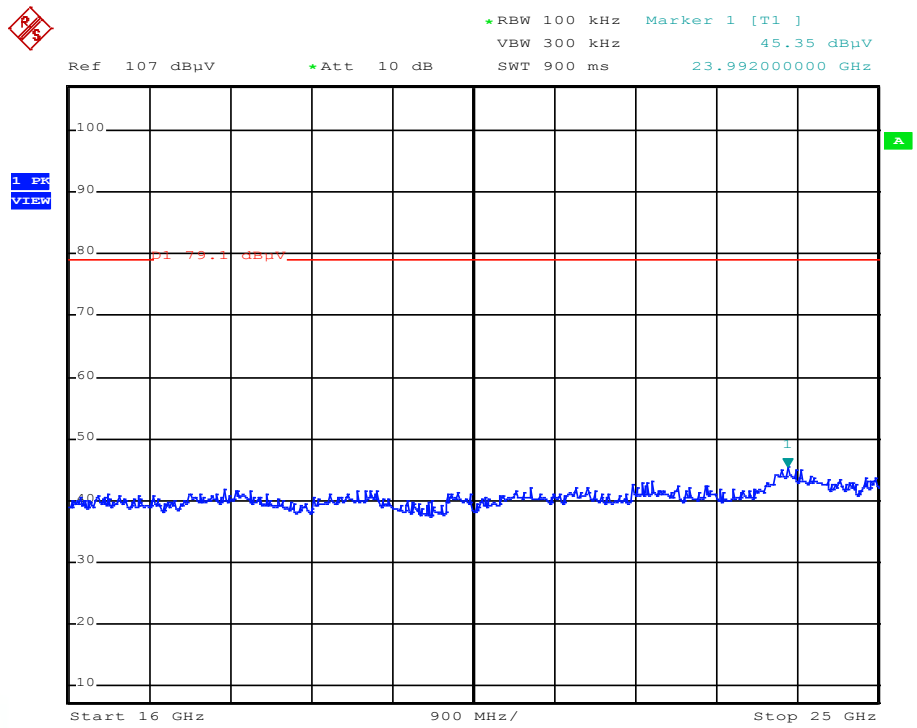


8 GHz – 16 GHz, Channel 40



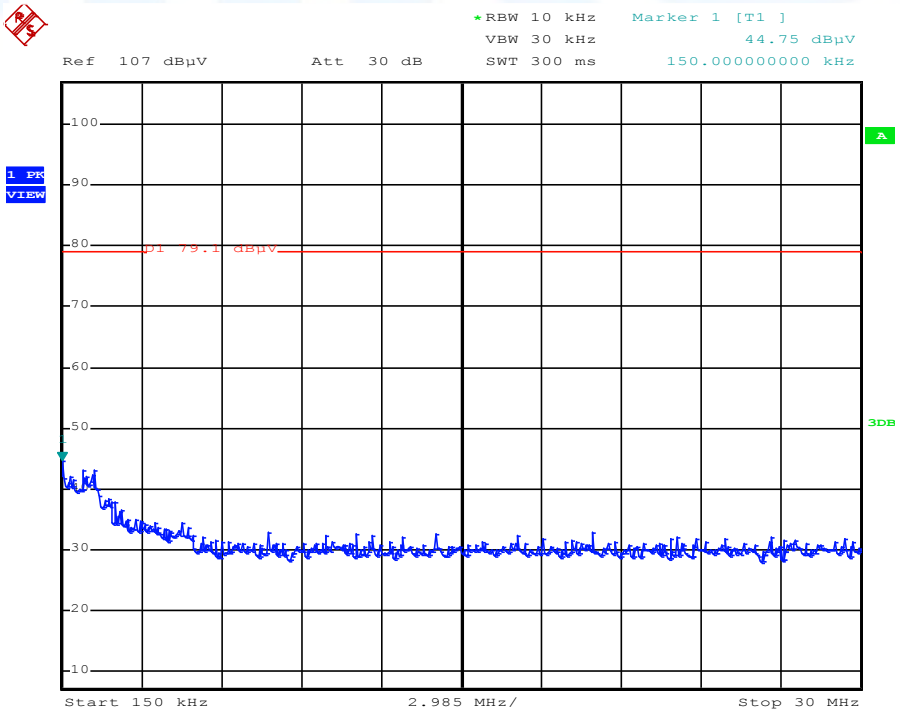
FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 40



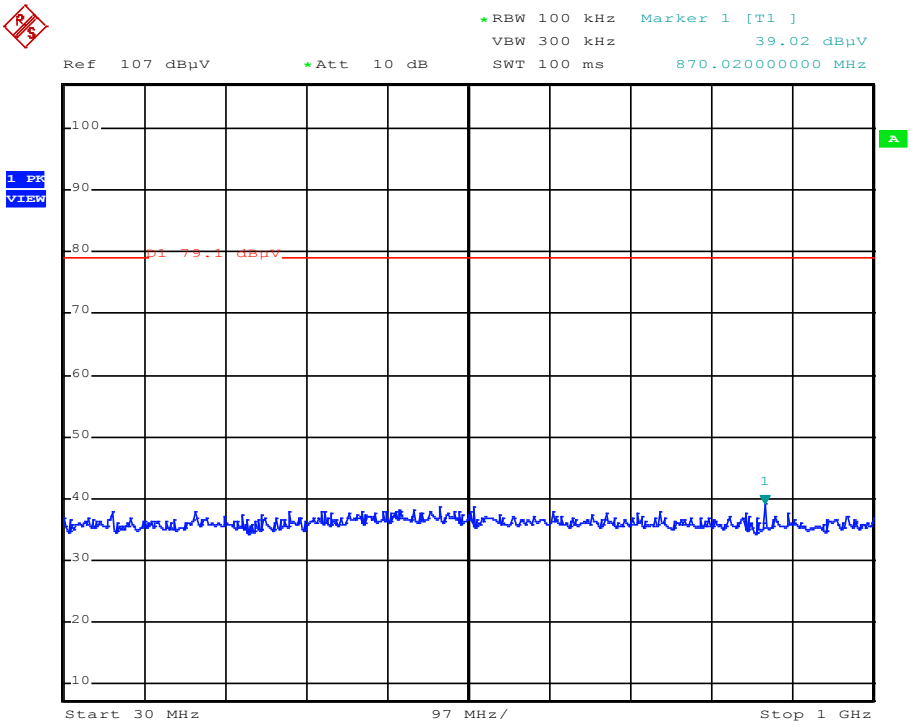
Spurious emissions conducted, 3-DH5 packet:

150 kHz – 30 MHz, Channel 79

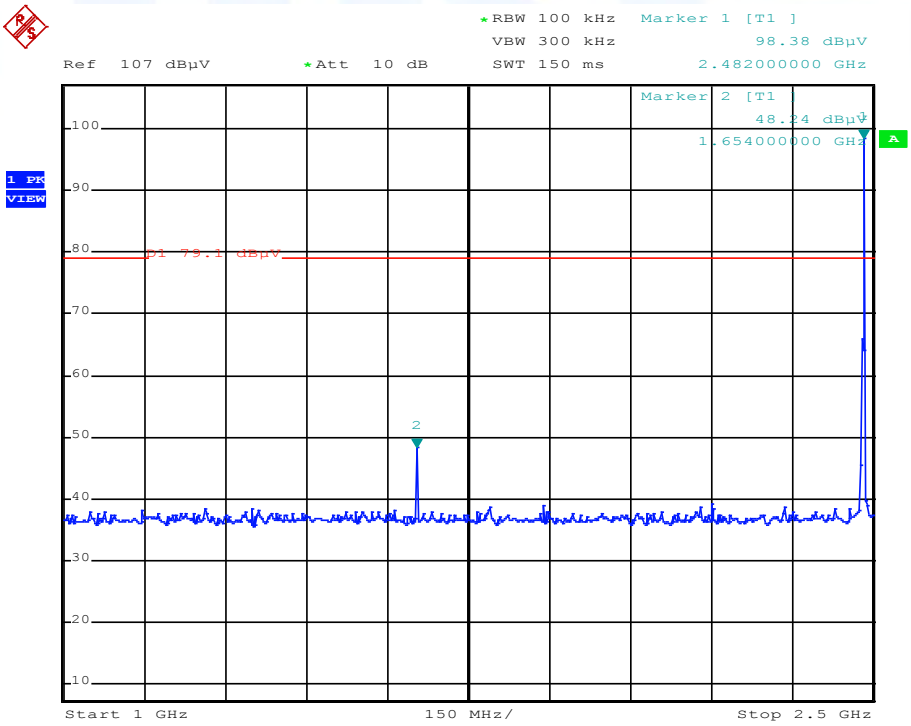


FCC ID:L2C0048TR

30 MHz – 1 GHz, Channel 79

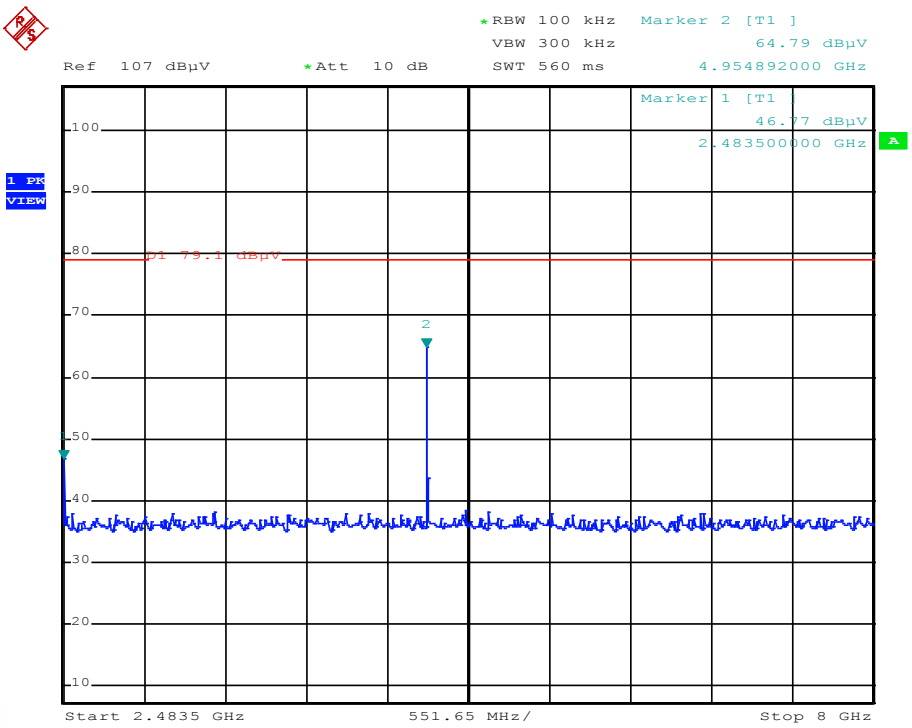


1 GHz – 2.5 GHz, Channel 79

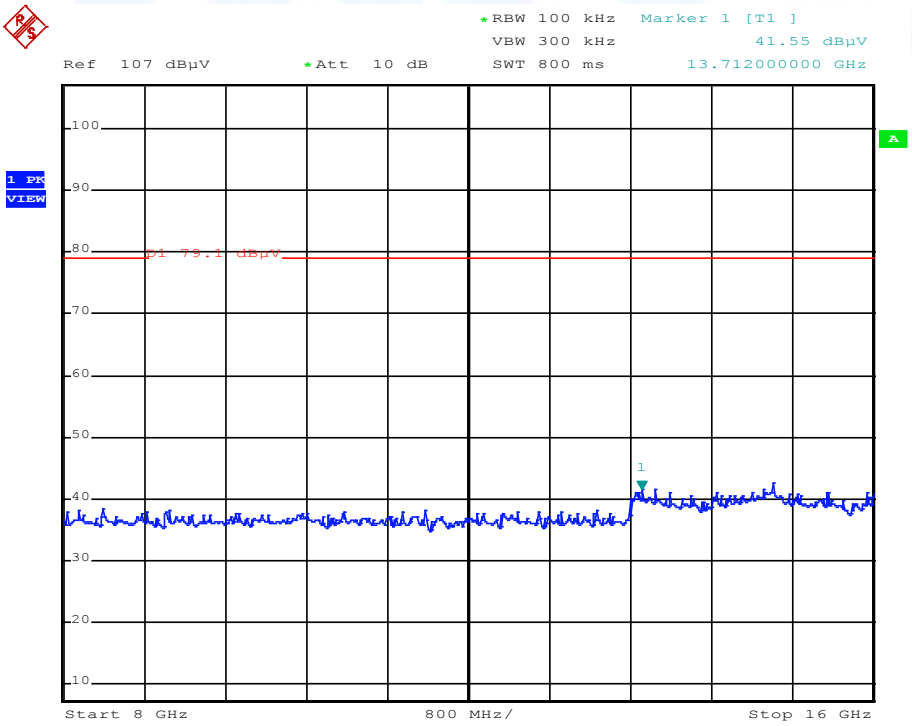


FCC ID:L2C0048TR

2.5 GHz – 8 GHz, Channel 79

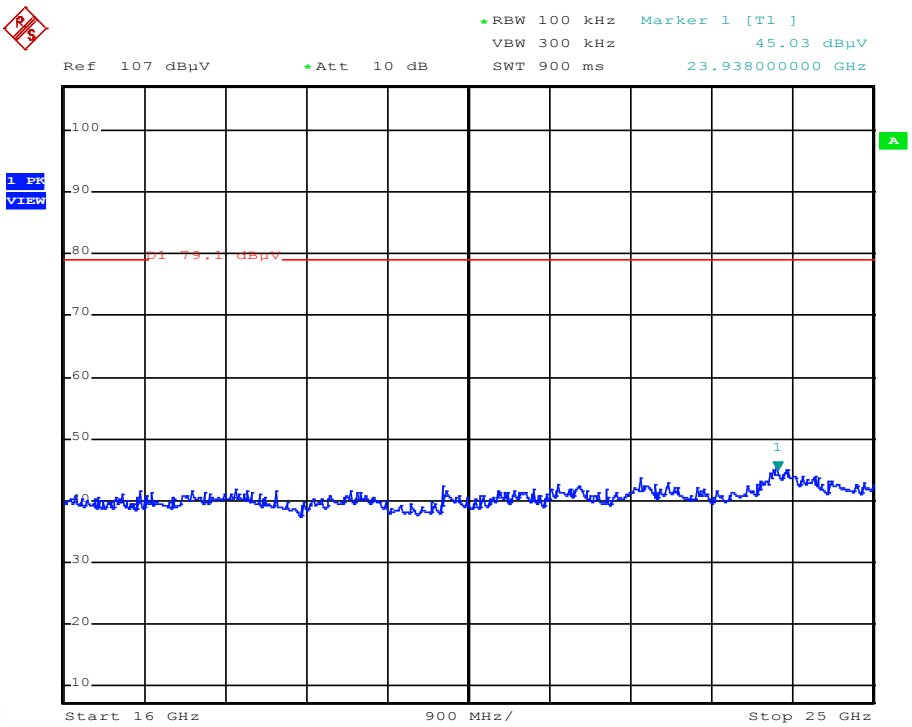


8 GHz – 16 GHz, Channel 79



FCC ID:L2C0048TR

16 GHz – 25 GHz, Channel 79



4.5 Band edge compliance

For test instruments and accessories used see section 6 Part **SEC3**.

4.5.1 Description of the test location

Test location: AREA4

4.5.2 Applicable standard

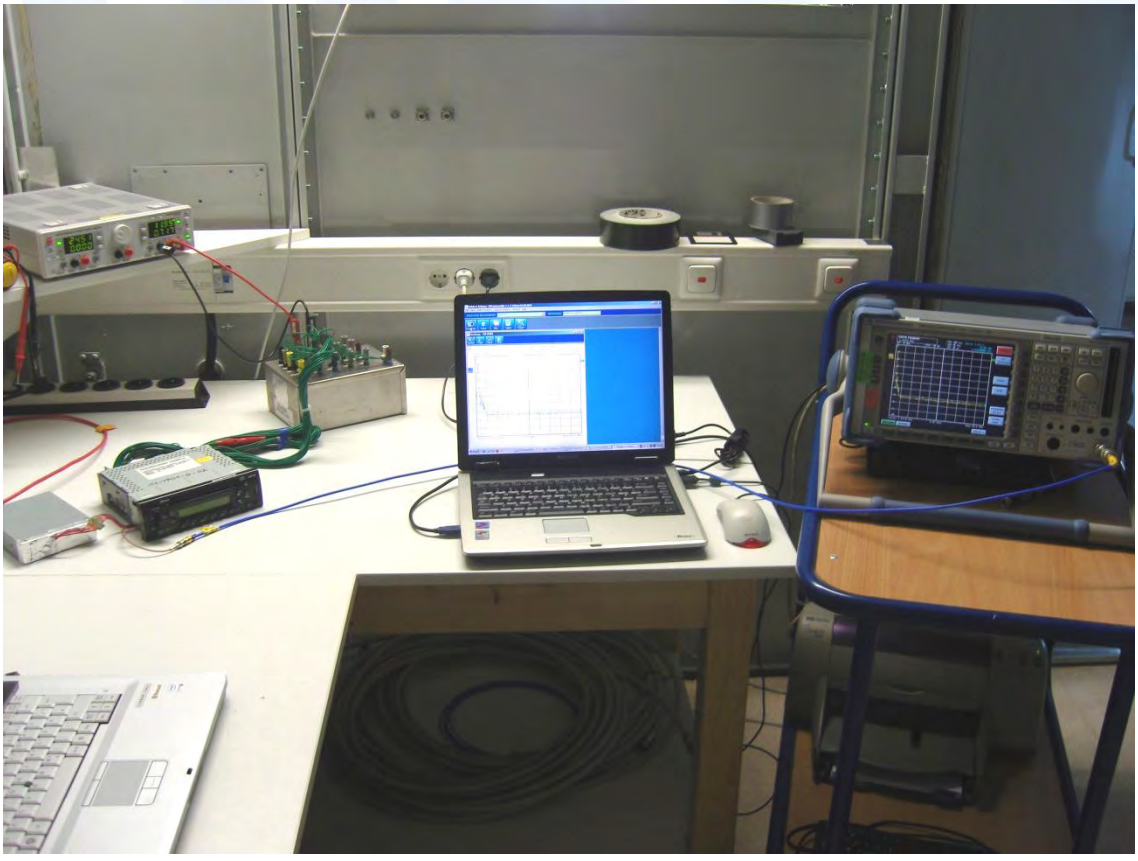
According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.5 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

4.5.3 Description of Measurement

A spectrum analyser is connected to the output of the transmitter via a suitable attenuator while EUT was operating in transmit mode at the assigned frequency according DA 00-705:2000.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Trace: Max hold, Sweep: auto

4.5.4 Photo documentation of the test set-up



4.5.5 Test result

DH5 Packet

f (MHz)	Delta level (dBc)	Limit (dBc)
Low Channel	-37.2	< -20
High Channel	-49.2	< -20

2DH5 Packet

f (MHz)	Delta level (dBc)	Limit (dBc)
Low Channel	-42.9	< -20
High Channel	-52.7	< -20

3DH5 Packet

f (MHz)	Delta level (dBc)	Limit (dBc)
Low Channel	-42.6	< -20
High Channel	-45.2	< -20

Hopping mode (3DH5 Packet)

f (MHz)	Delta level (dBc)	Limit (dBc)
Low Channel	-47.1	< -20
High Channel	-50.9	< -20

Peak-Limit according to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

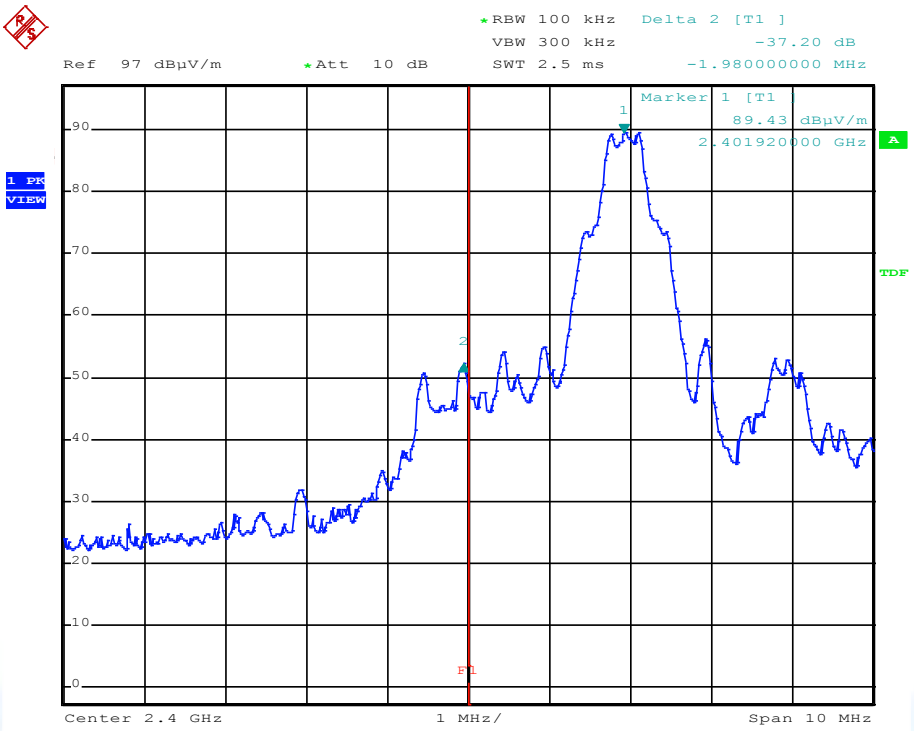
The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocols.

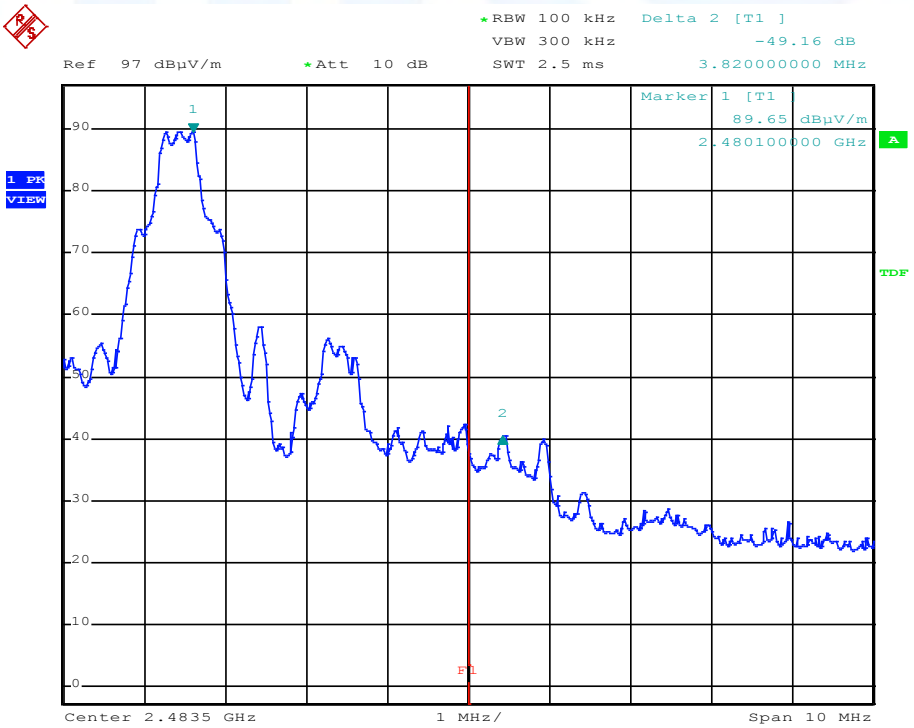
FCC ID:L2C0048TR

4.5.6 Test protocol

DH5 Packet, CH1

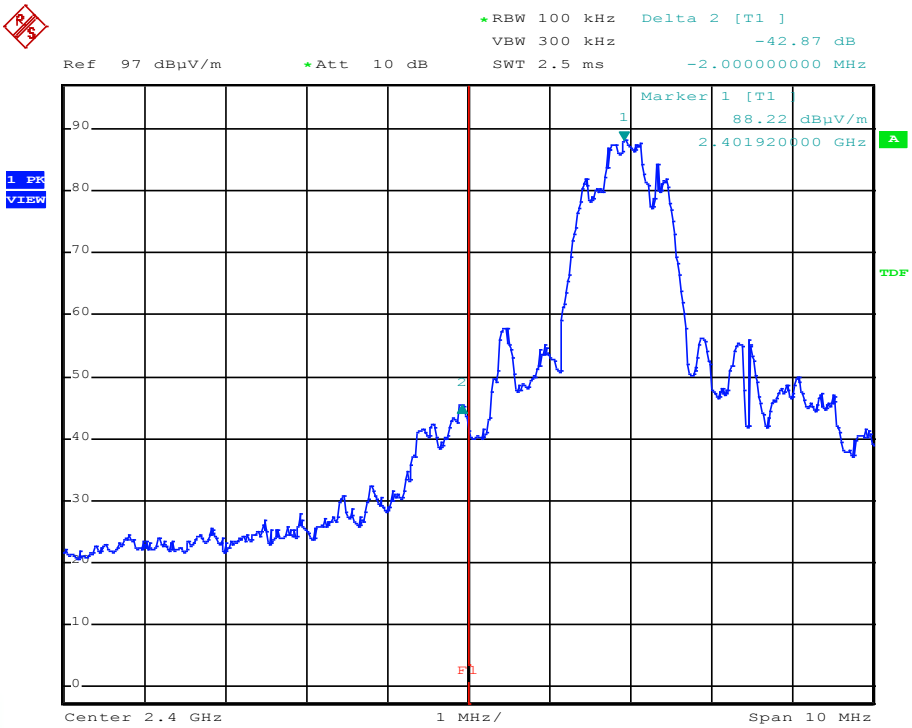


CH79

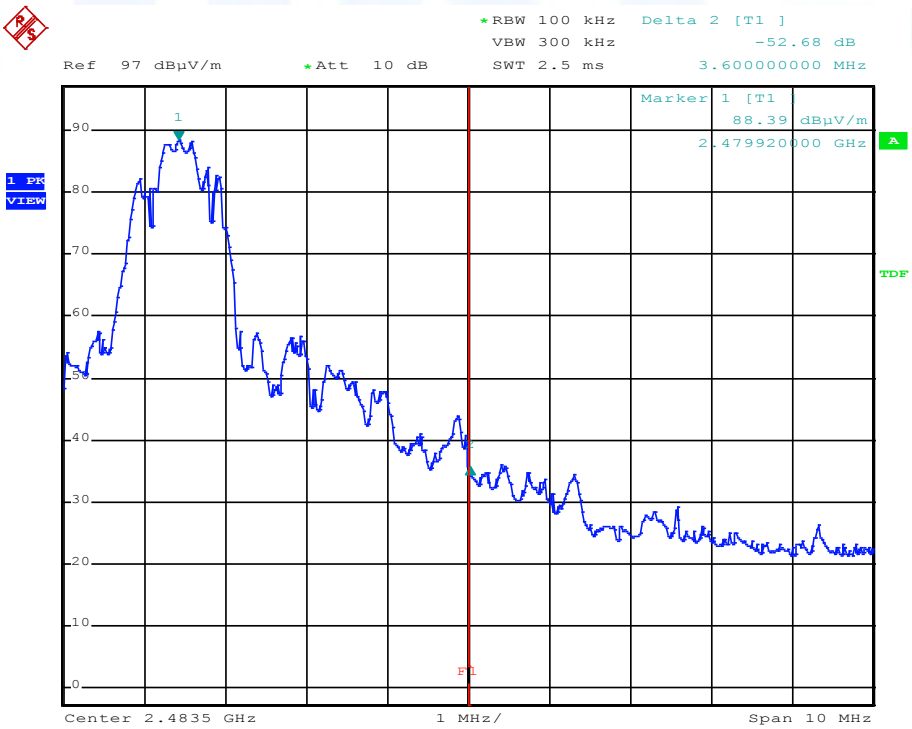


FCC ID:L2C0048TR

2-DH5 Packet, CH1

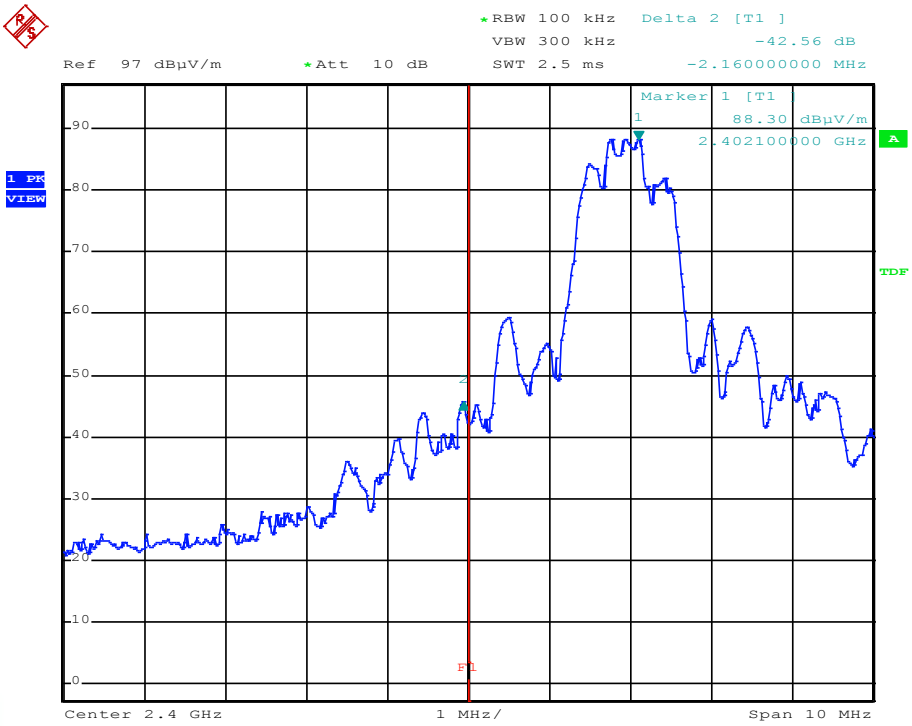


CH79

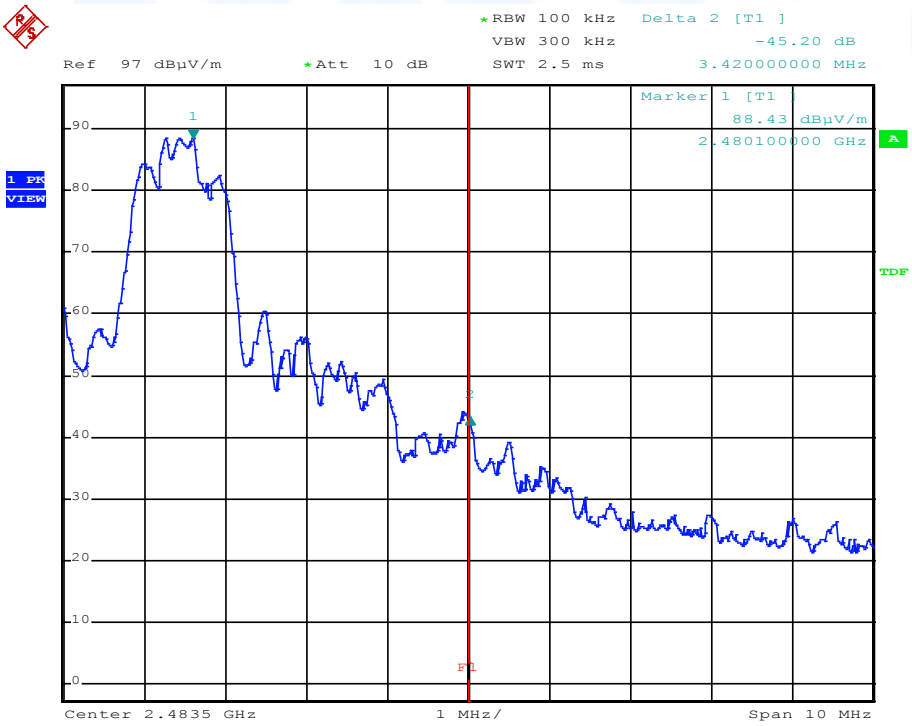


FCC ID:L2C0048TR

3-DH5 Packet, CH1

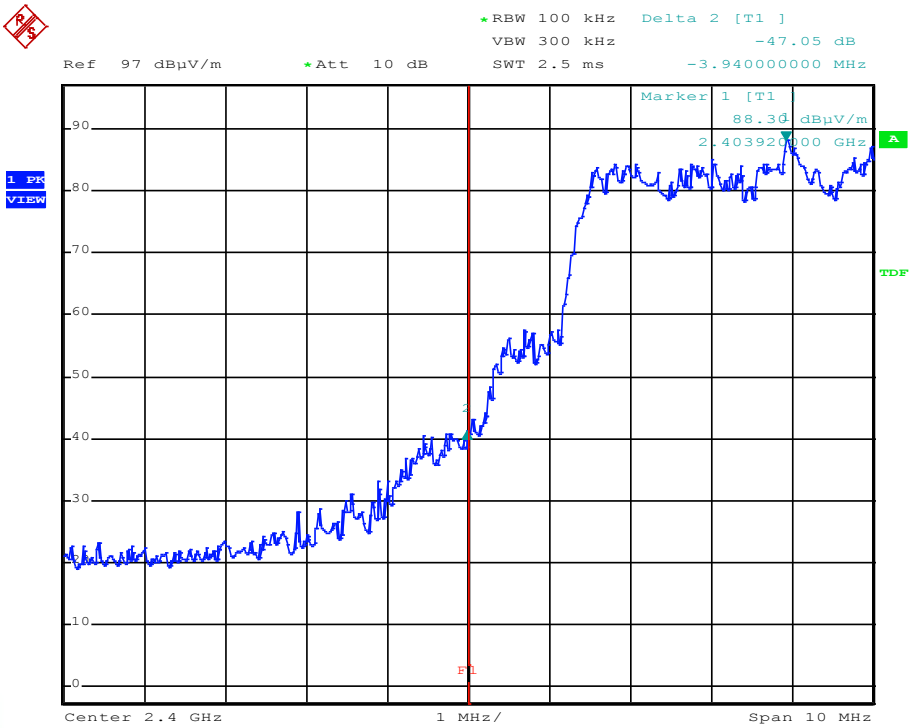


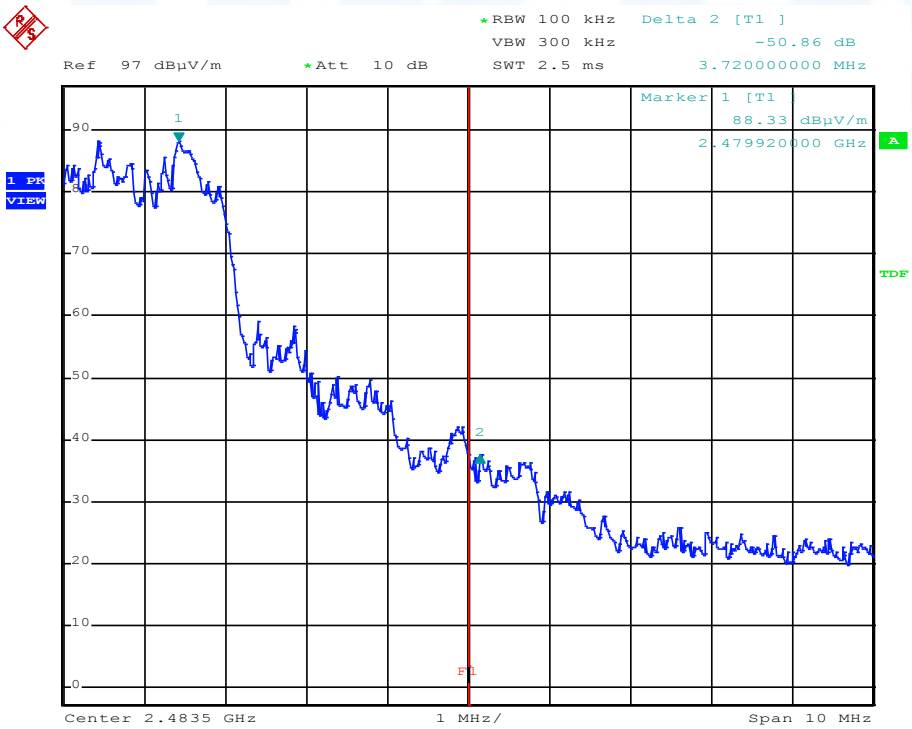
CH79



FCC ID:L2C0048TR

Hopping mode (3-DH5 Packet)





4.6 Radiated emissions in restricted bands

For test instruments and accessories used see section 6 Part **SER3**.

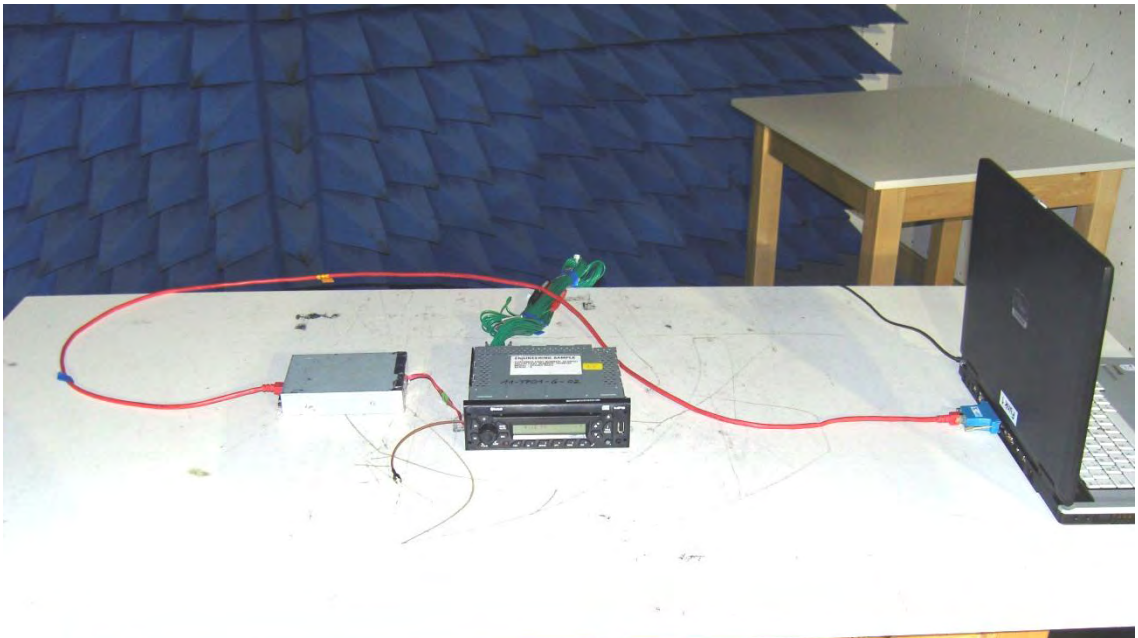
4.6.1 Description of the test location

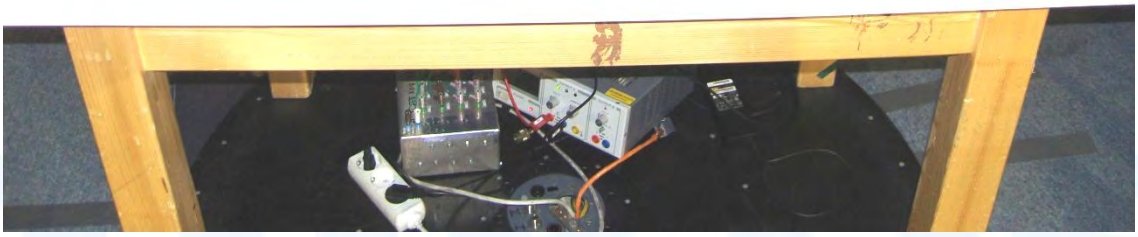
Test location: Anechoic Chamber A2

Test distance: 3 metres

4.6.2 Photo documentation of the test set-up

Test setup 1 – 18 GHz





4.6.3 Applicable standard

According to FCC Part 15, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

4.6.4 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser was set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

Spectrum analyser settings:
RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Detector function: Peak

4.6.5 Test result

Restricted band 1435 – 1626.5 MHz:

CH1:

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	1602	42.8	74.0	54.0	-31.2
2DH5	1602	43.5	74.0	54.0	-30.5
3DH5	1602	43.9	74.0	54.0	-30.1

Restricted band 2310 – 2390 MHz:

CH1:

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	2332	43.4	74.0	54.0	-30.6
2DH5	2321	41.4	74.0	54.0	-32.6
3DH5	2321	42.8	74.0	54.0	-31.2

Restricted band 2483.5 – 2500 MHz:

CH79

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	2483.5	45.5	74.0	54.0	-28.5
2DH5	2482.5	51.0	74.0	54.0	-23.0
3DH5	2483.5	47.5	74.0	54.0	-26.5

Restricted band 4500 – 5150 MHz:

CH1:

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	4804	53.6	74.0	54.0	-20.4
2DH5	4804	47.8	74.0	54.0	-26.2
3DH5	4804	49.2	74.0	54.0	-24.8

CH79:

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	4960	56.9	74.0	54.0	-17.1
2DH5	4960	53.1	74.0	54.0	-20.9
3DH5	4960	52.7	74.0	54.0	-21.3

CH79, AV measurement

Modulation Packet	Frequency (MHz)	L: AV hor dB(µV/m)	L: AV ver dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	4960	49.8	49.9	54.0	-4.1

Restricted band 2655 – 2900 MHz (Canada):

CH79

Modulation Packet	Frequency (MHz)	L: PK dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
DH5	2656	47.2	74.0	54.0	-26.8
2DH5	2655	46.9	74.0	54.0	-27.1
3DH5	2657	46.5	74.0	54.0	-27.5

FCC ID:L2C0048TR

Peak-Limit according to FCC Part 15C, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

Frequency	Limits acc. 15.209		Measurement distance
(MHz)	PK dB(µV/m)	AV dB(µV/m)	(m)
Above 960	74	54	3

Restricted bands of operation:
The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209:

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

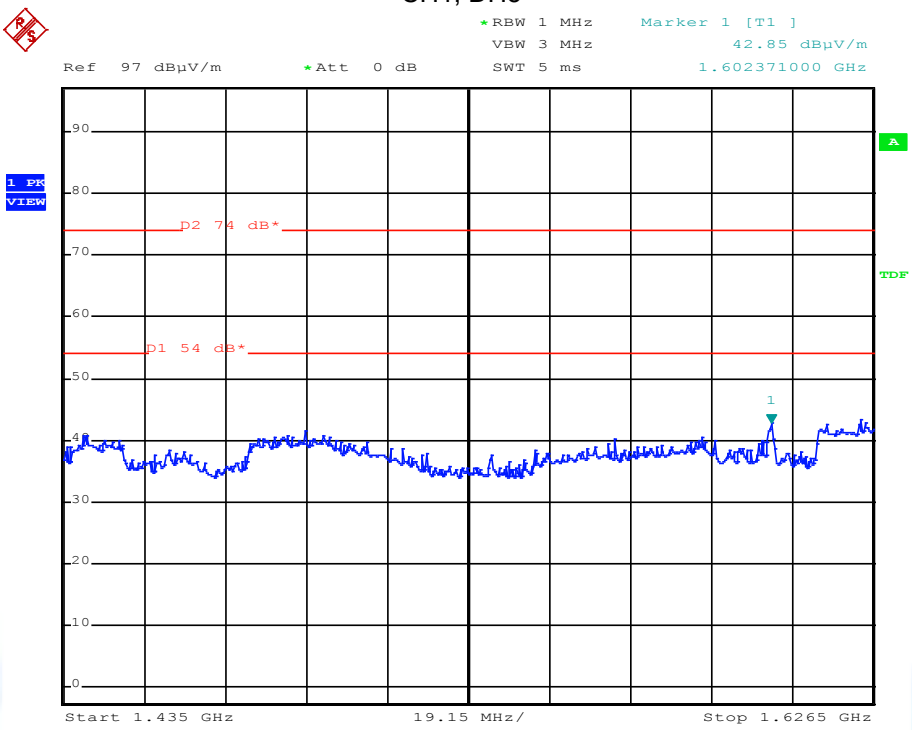
The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol. Only the worst case plots are listed.

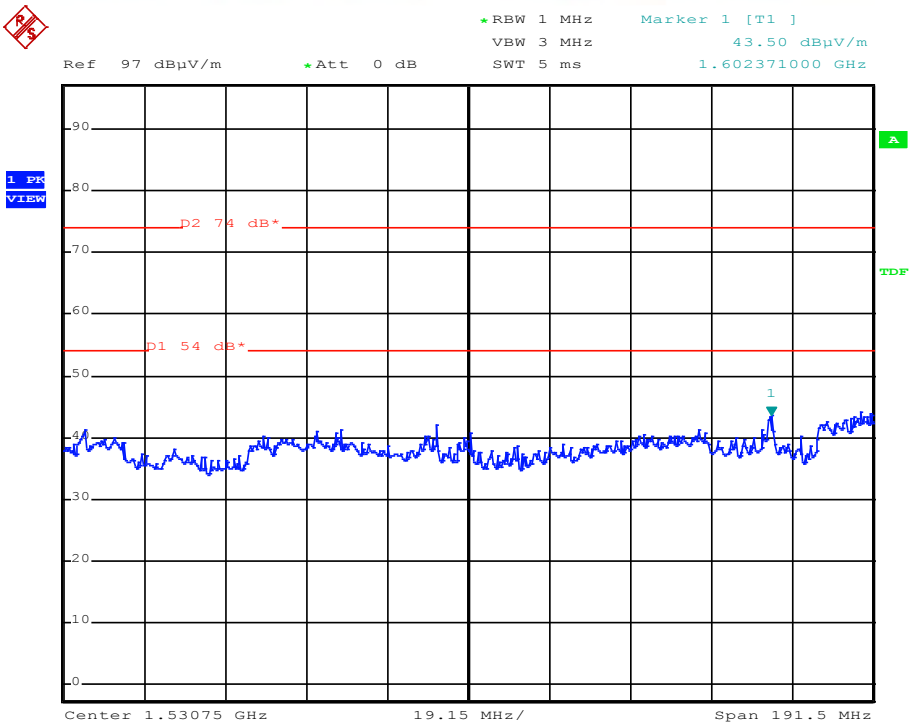
4.6.6 Test protocol

Restricted band 1435 – 1626.5 MHz:

CH1, DH5

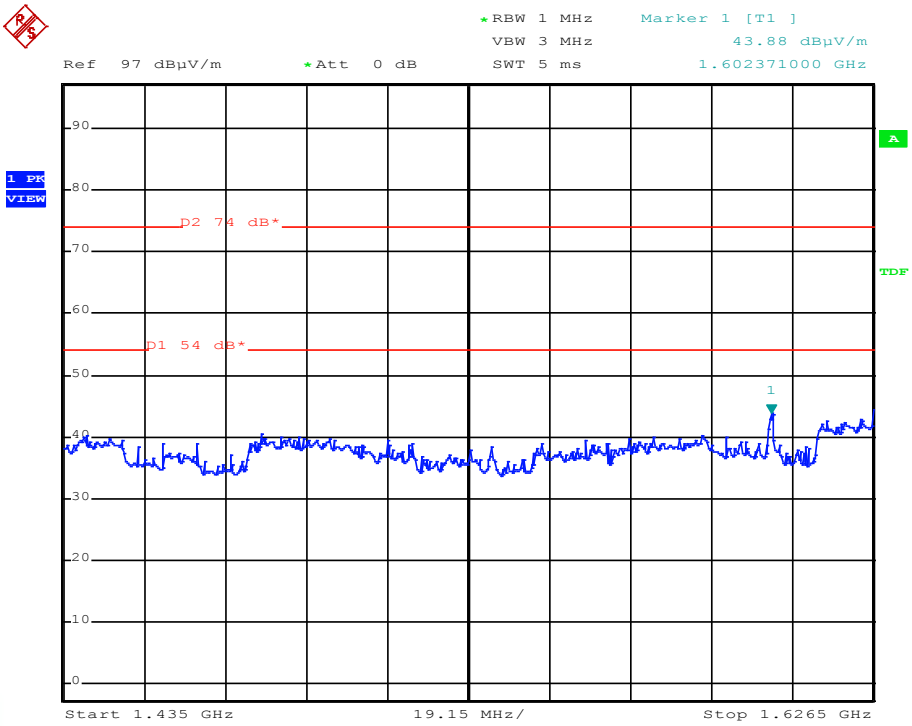


CH1, 2DH5



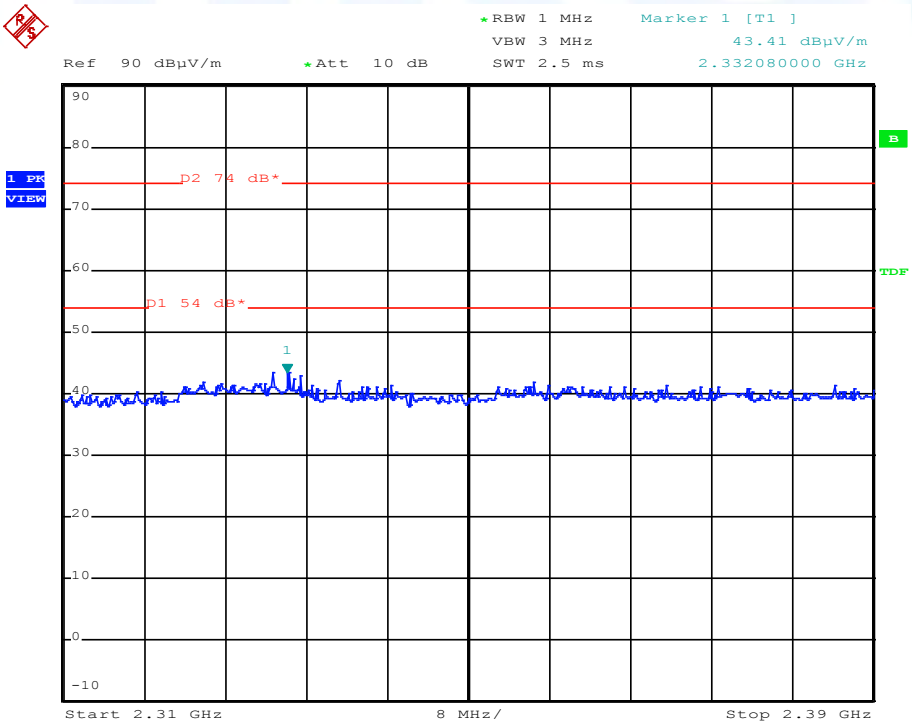
FCC ID:L2C0048TR

CH1, 3DH5



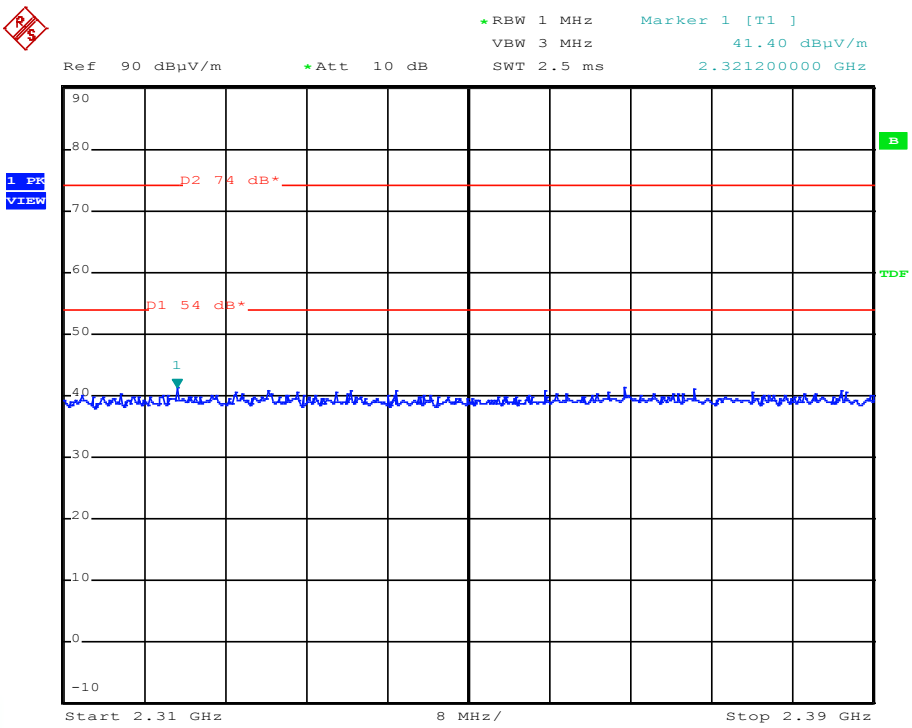
Restricted band 2310 – 2390 MHz:

CH1, DH5

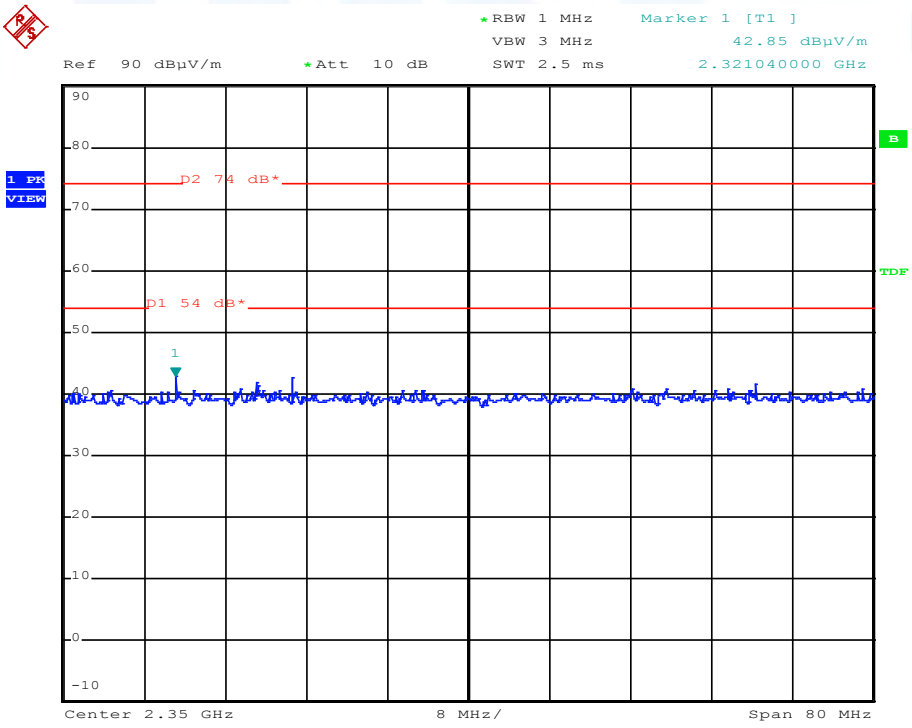


FCC ID:L2C0048TR

CH1, 2DH5



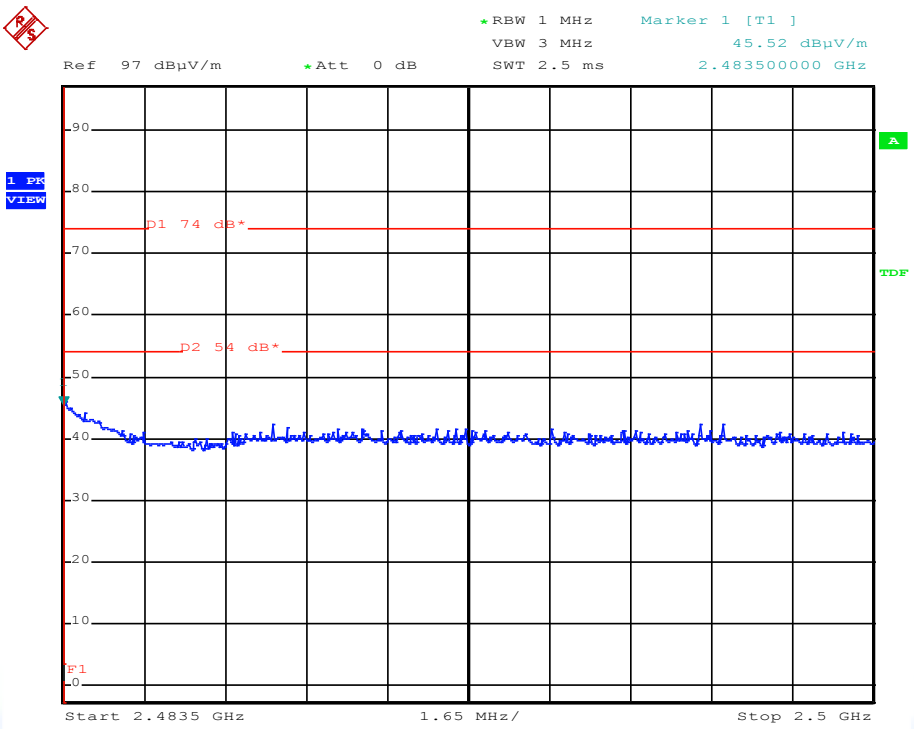
CH1, 3DH5



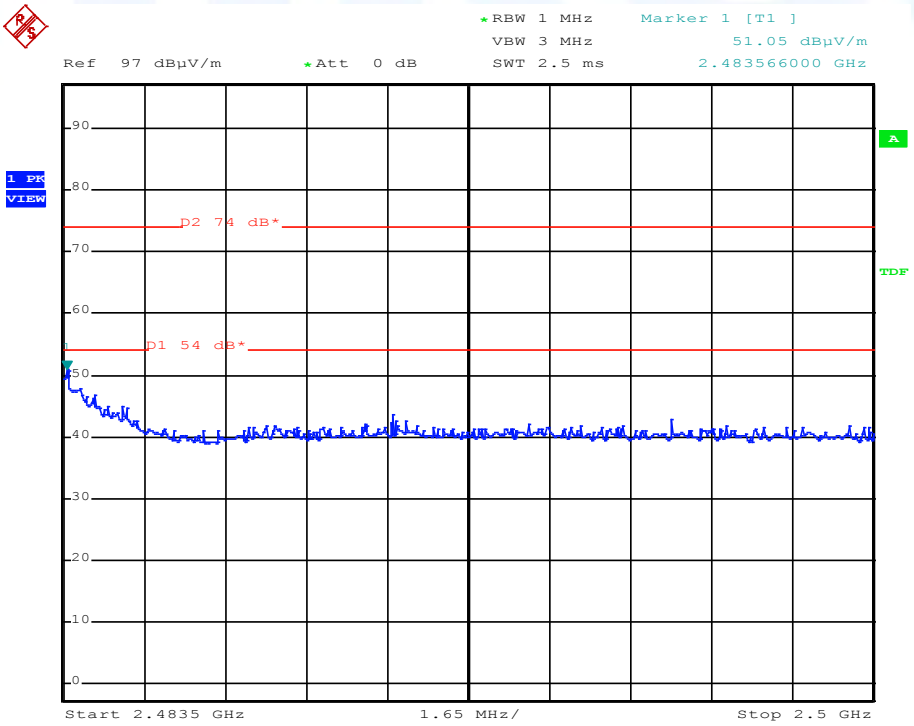
FCC ID:L2C0048TR

Restricted band 2483.5 – 2500 MHz:

CH79, DH5

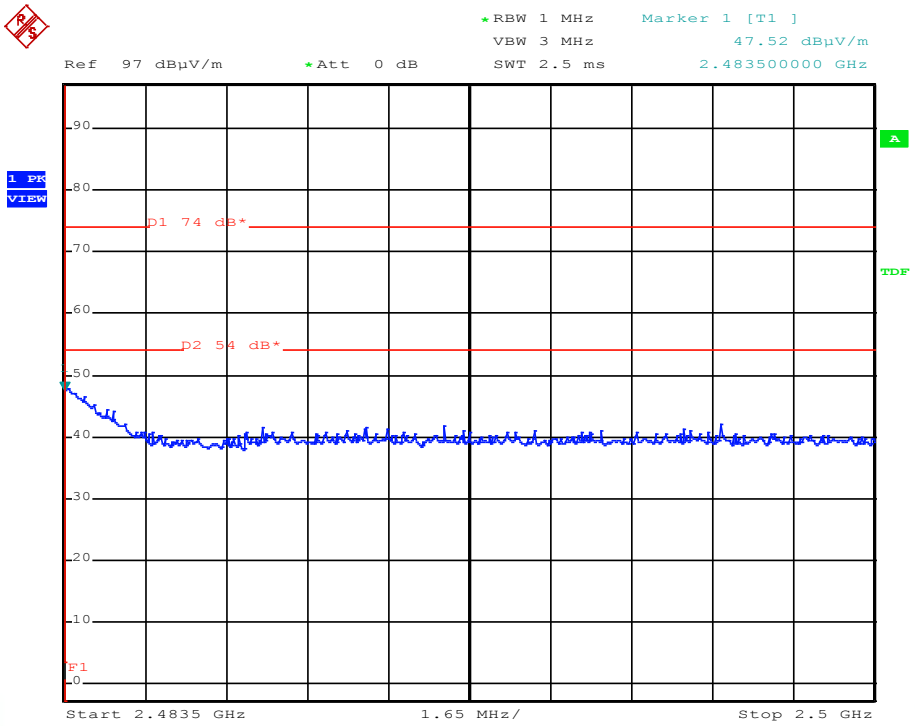


CH79, 2DH5



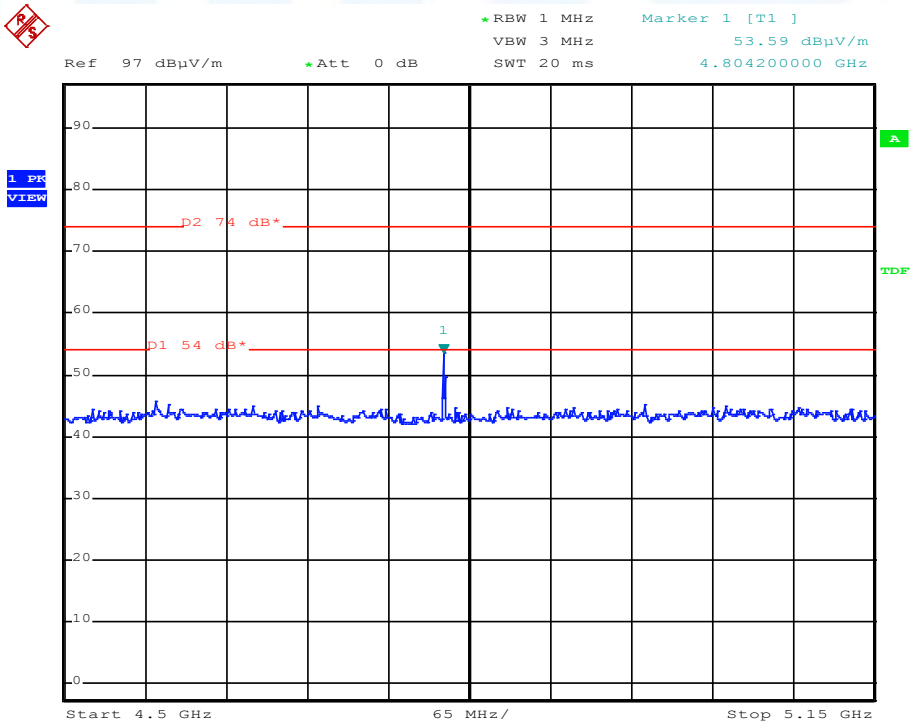
FCC ID:L2C0048TR

CH79, 3DH5



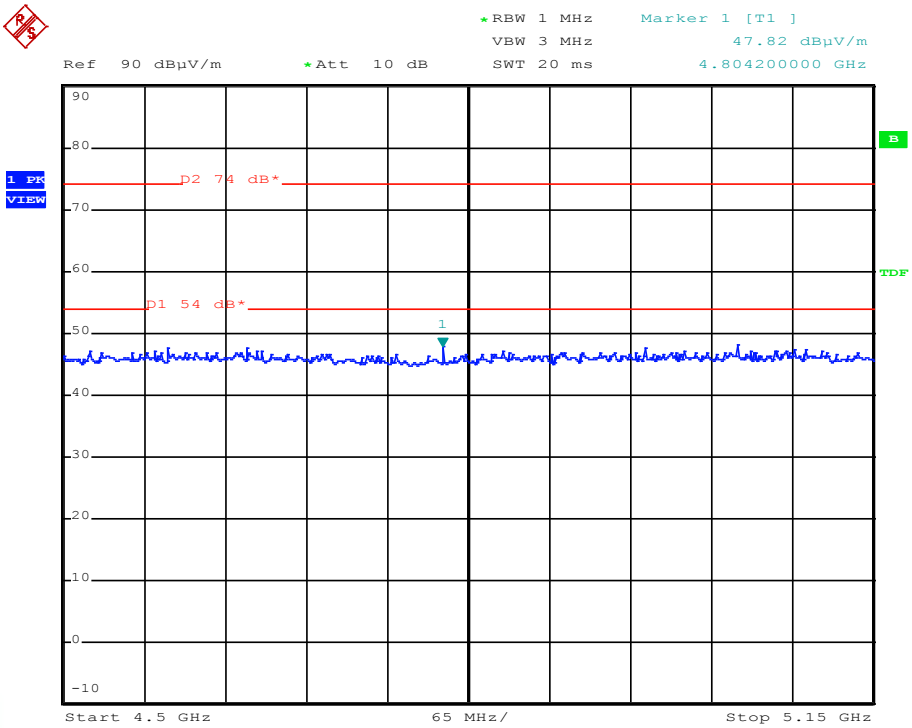
Restricted band 4500 – 5150 MHz:

CH1, DH5

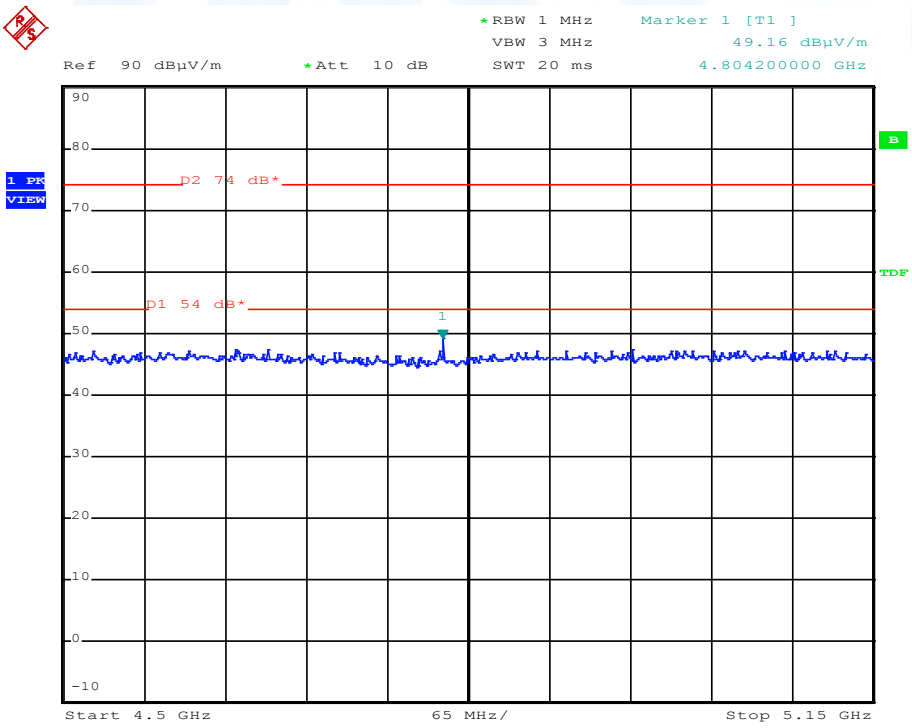


FCC ID:L2C0048TR

CH1, 2DH5

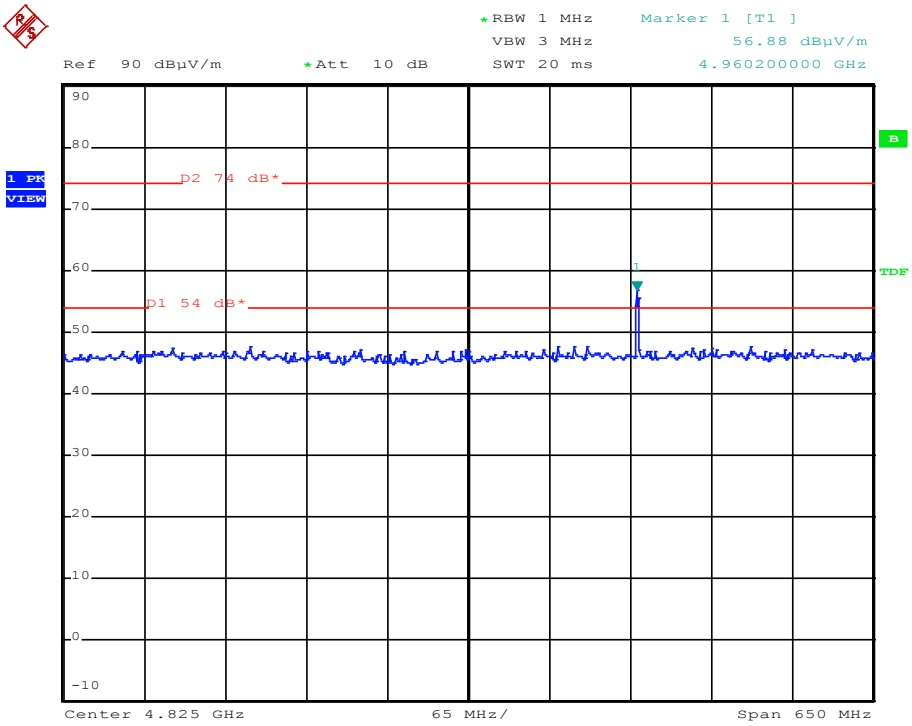


CH1, 3DH5

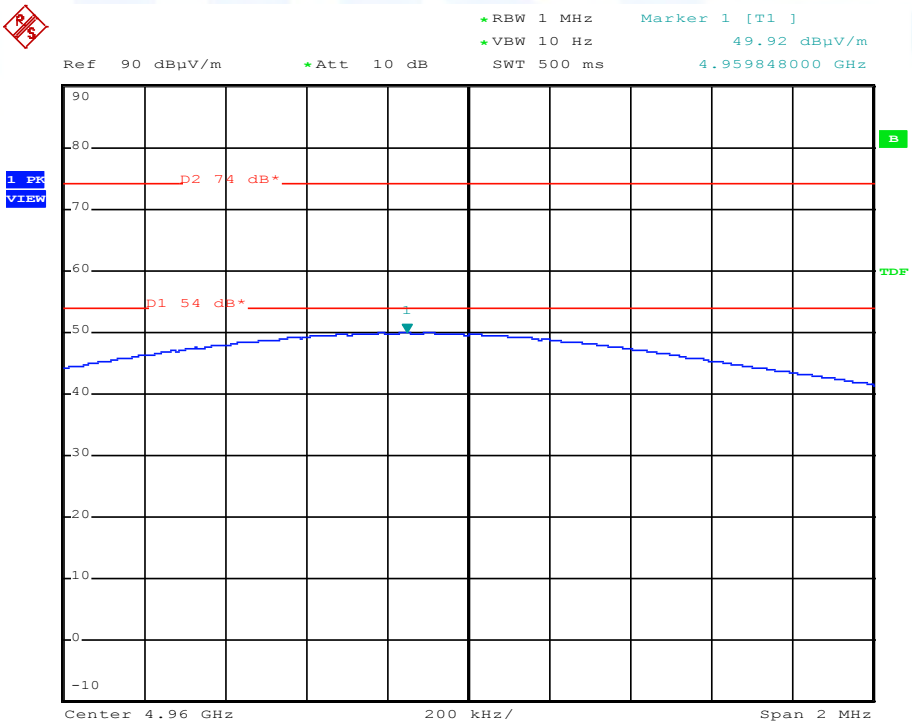


FCC ID:L2C0048TR

CH79, DH5

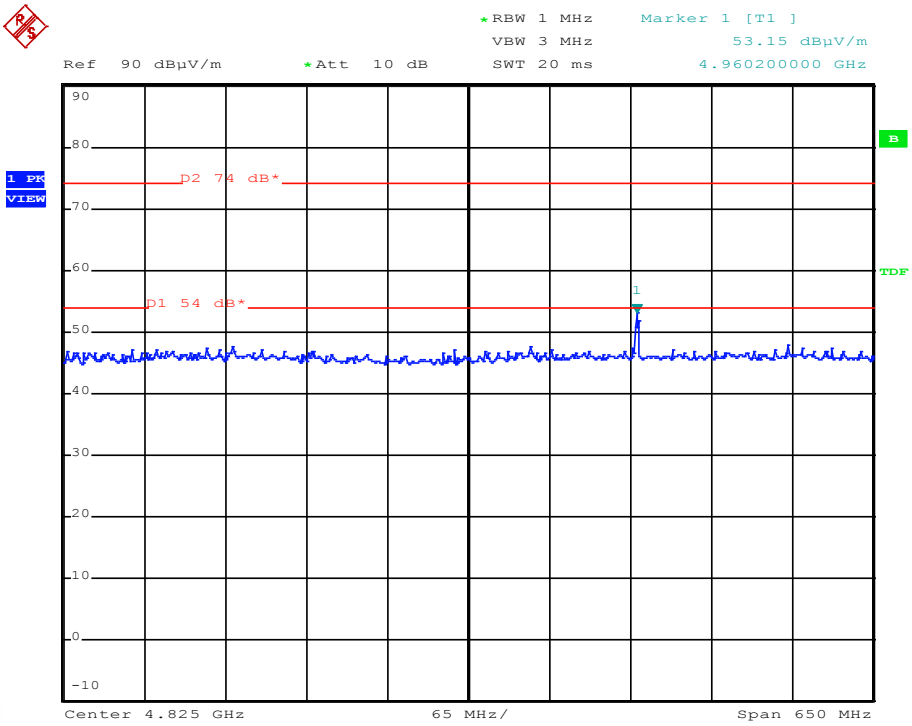


CH79, DH5, AV measurement

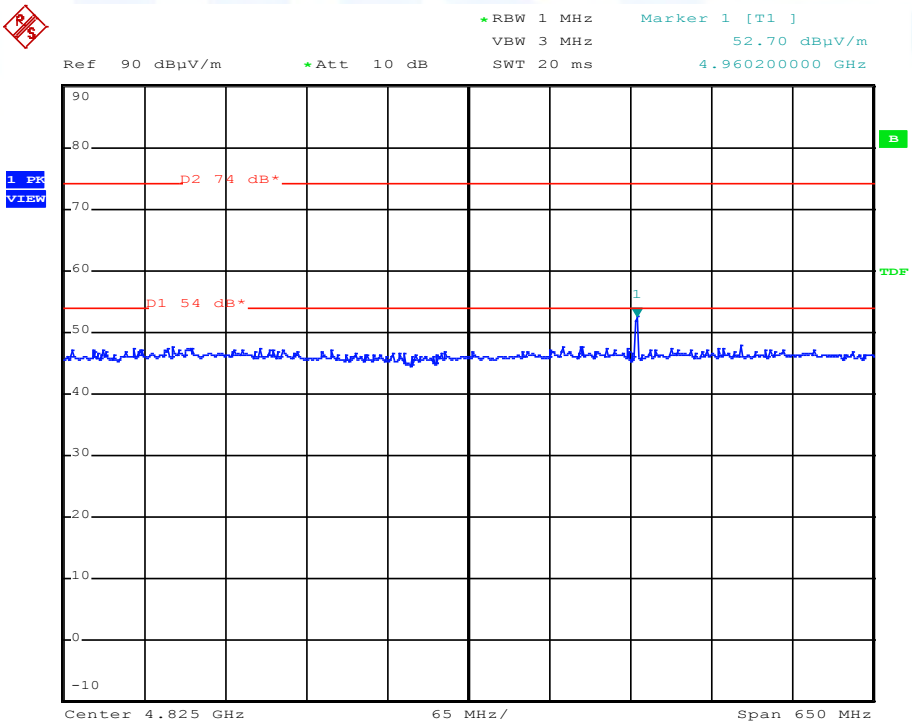


FCC ID:L2C0048TR

CH79, 2DH5



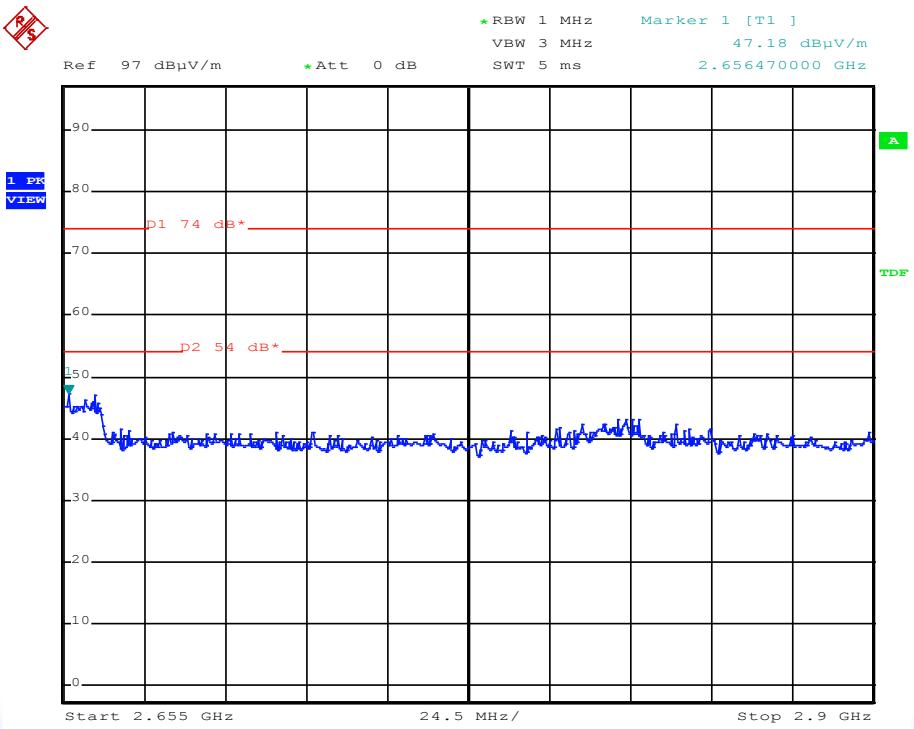
CH79, 3DH5



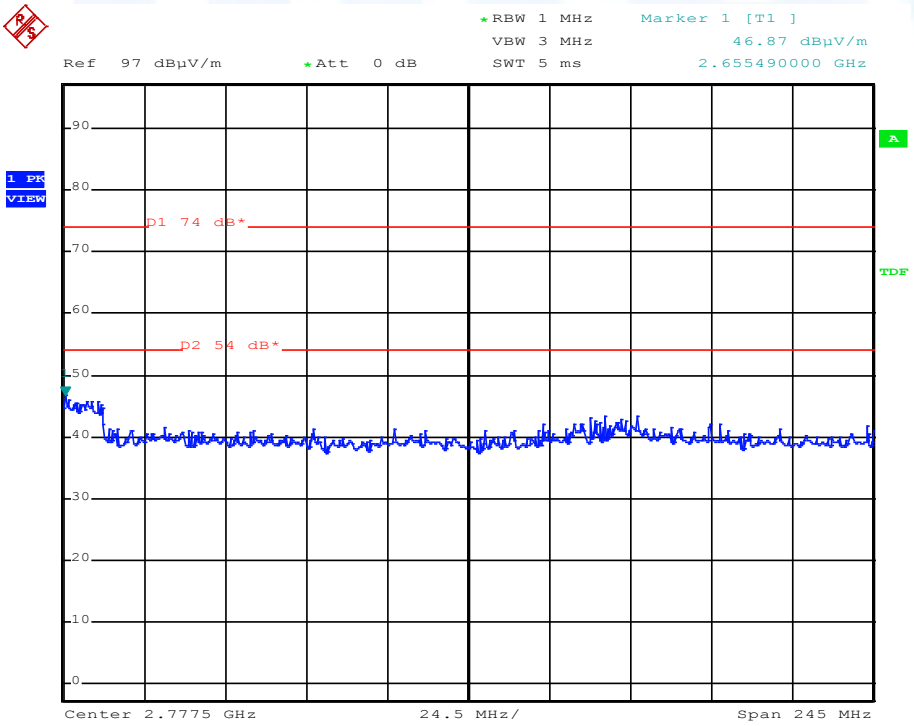
FCC ID:L2C0048TR

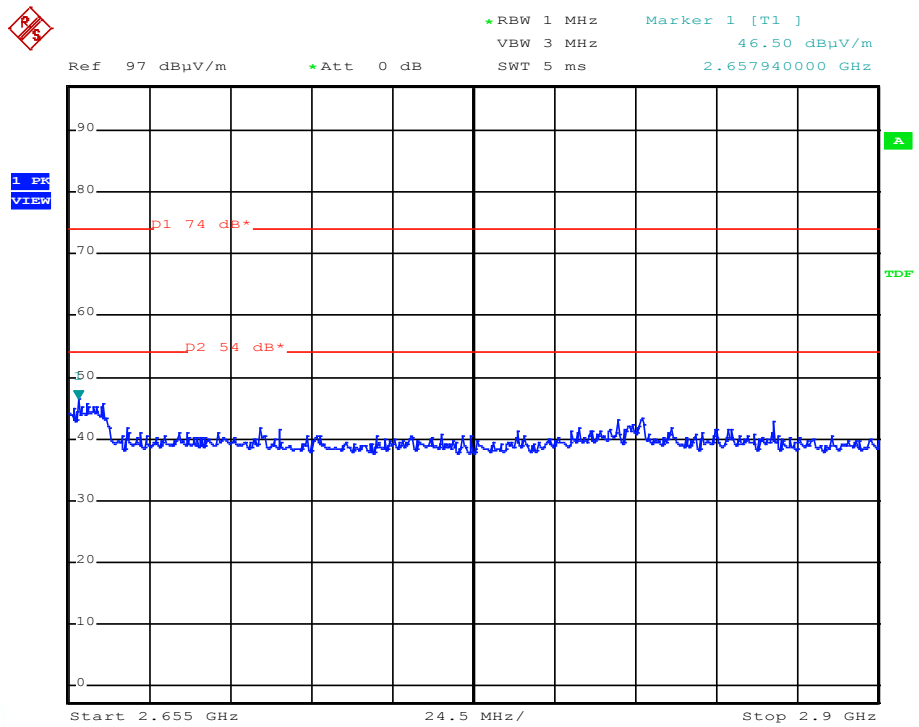
Restricted band 2655 – 2900 MHz:

CH79, DH5



CH79, 2DH5





4.7 Pseudorandom frequency hopping sequence

Requirement according to FCC Part 15C, Section 15.247(a):
The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:
Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consists of maximum 8 Bluetooth units. One unit is the master the other seven are the slaves. The master unit co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from its BD address which is unique for each Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.
Example of a 79 hopping sequence in data mode:
40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

Derivation and examples for a hopping sequence in hybrid mode
For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see chapter 5), but this time with different input vectors:
a. For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
b. For the page hop sequence, the device address of the paged unit is used as input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.
So it is ensured that also in hybrid mode the frequency use equally averaged.

Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23
Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

4.8 Equal hopping frequency use

Requirement according to FCC Part 15C, Section 15.247(a):
Each frequency must be used equally on the average by each transmitter.

The generation of the hopping sequence in connection mode depends essentially on two input values:
1. LAP/UAP of the master of the connection.
2. Internal master clock.
The LAP (lower address part) is the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the Rx/Tx slot length of 312.5 µs. The clock has a cycle of about one day (23hr30min). In most case, it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.
Regarding short transmissions the Bluetooth system has the following behaviour: The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value the hopping sequence will always differ from the first one, because the period between the two transmissions is longer and it cannot be shorter than the minimum resolution of the clock is 312.5 µs. This circumstance is always the same therefore the average of the frequency use is the same on all transmitters.

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

4.9 Receiver input bandwidth

Requirement according to FCC Part1 5C, Section 15.247(a):
The system receivers shall have input bandwidth that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signal.

Receiver input bandwidth and behaviors for repeated single or multiple packets:
The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between Rx and Tx time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its Tx/Rx timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

4.10 Correction for pulsed operation (duty cycle)

Remarks: Not applicable.

4.11 Dwell time

4.11.1 Applicable standard

According to FCC Part 15, Section 15.247(a):
In Section 15.247(a)(1i)(1ii) and (1iii) are dwell times defined for the special frequency ranges should not exceed by a frequency hopping system.

Dwell time in data mode:
The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 * 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 * 1/s / 79 * 30s = 0.3797s (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. There for all Bluetooth devices comply with the FCC dwell time requirement in data mode.
This was checked during the Bluetooth Qualification tests and approved.

The Dwell time in hybrid mode is approximately 2.6 ms (in a 12.8 s period).

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

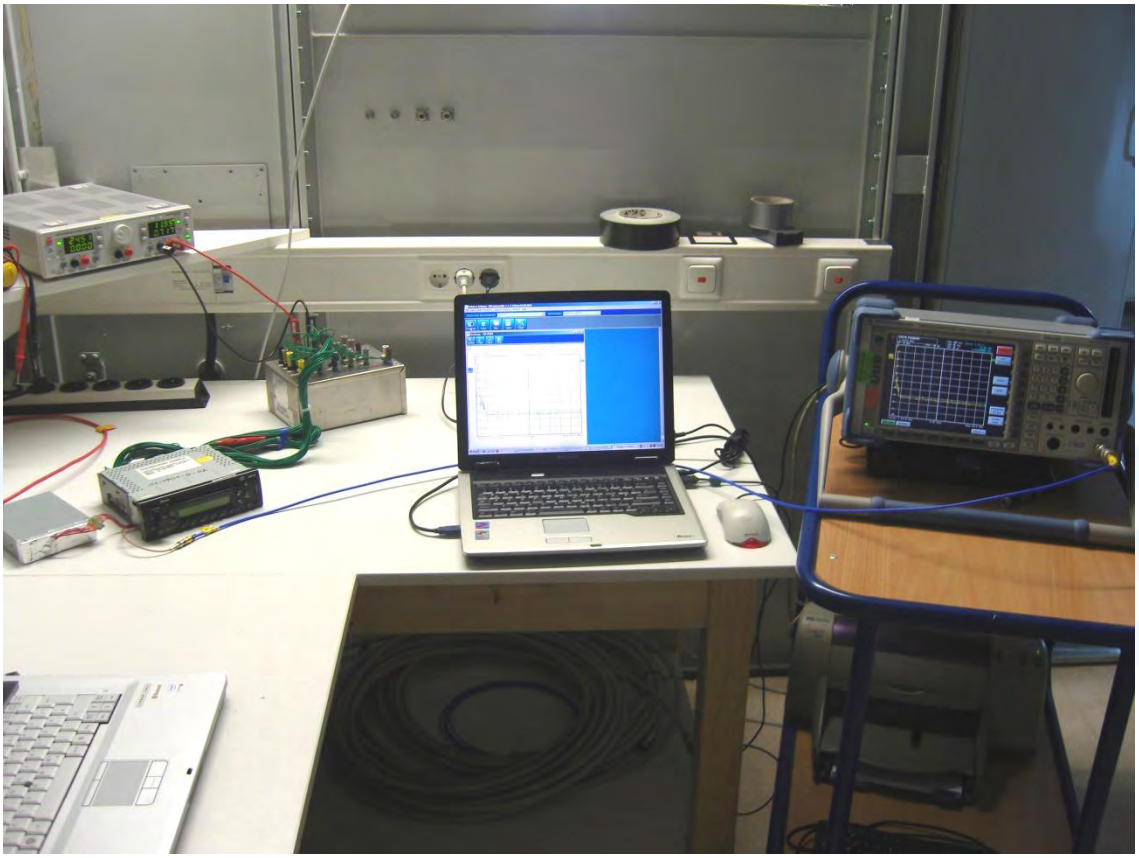
4.12 Carrier frequency separation

For test instruments and accessories used see section 6 Part **MB**.

4.12.1 Description of the test location

Test location: AREA4

4.12.2 Photo documentation of the test set-up



4.12.3 Applicable standard

According to FCC Part 15, Section 15.247(a):
Frequency hopping systems operating in the frequency band of 2400 MHz – 2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or 2/3 of the 20 dB bandwidth of the hopping channel.

4.12.4 Description of Measurement

The measurement is performed using a spectrum analyser in single sweep mode. A part of the operating frequency is used for better resolution. In normal application mode all the channels of the part of operating frequency are displayed and the separation is measured. The 20 dB OBW has to be measured before to compare whether the OBW requirement is fulfilled.

4.12.5 Test result

Channel separation in hybrid mode:
The nominal channel spacing of the Bluetooth system is 1MHz independent of the operating mode. The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is f_{center} = 75 kHz.
This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402 MHz, 2441 MHz, and 2480 MHz) and approved.

Additionally an example for the channel separation is given below:

Channel	2/3 of 20 dB BW (MHz)	Hopping channels	Separation (MHz)	Limit
1	0.793	79	1.002	0.793
40	0.793	79	1.002	0.793
79	0.793	79	1.002	0.793

Limit according to FCC Part 15C, Section 15.247(a):

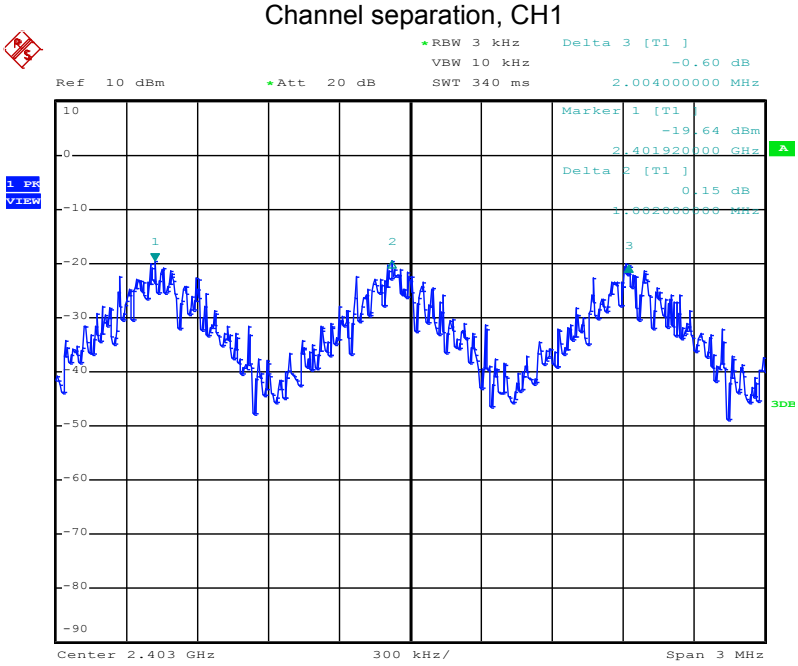
Frequency (MHz)	Hopping channels	Limit channel separation
All systems		> 25 kHz or 20 dB bandwidth, which ever is greater
2400 - 2483.5	≥ 15	> 25 kHz or 2/3 of 20 dB bandwidth, which ever is greater

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

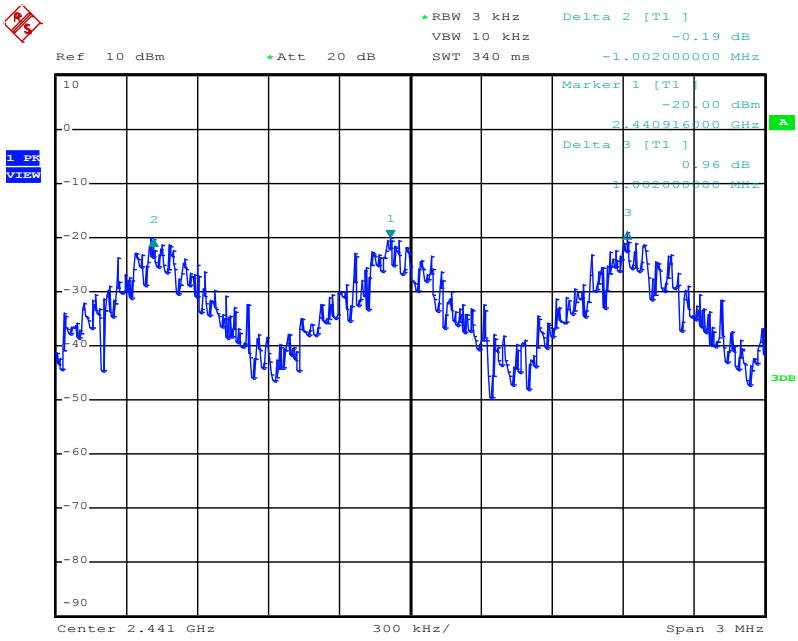
4.12.6 Test protocol

Channel separation, CH1

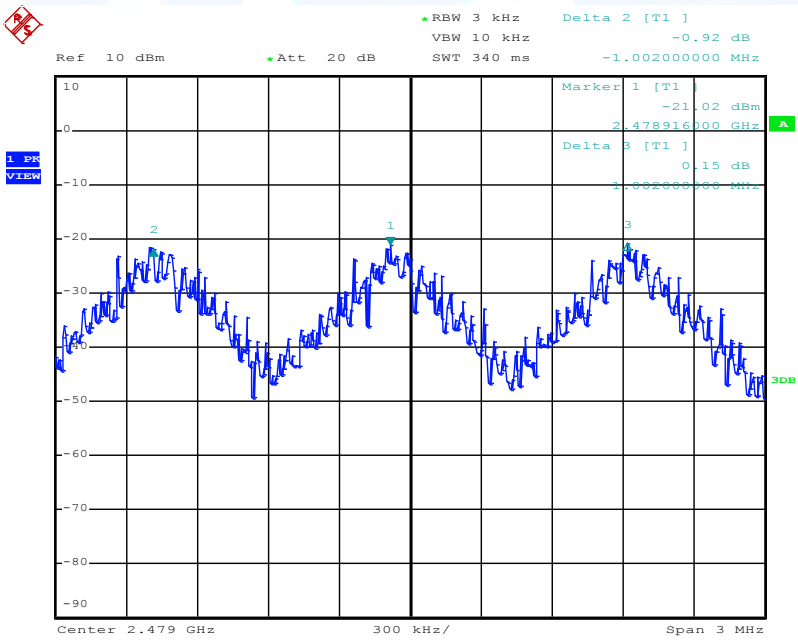


FCC ID:L2C0048TR

Channel separation, CH40



Channel separation, CH79



4.13 Number of hopping channels

For test instruments and accessories used see section 6 Part **MB**.

4.13.1 Description of the test location

Test location: AREA4

4.13.2 Test result

Hopping channel frequency range	Number of all available hopping channels
2402 - 2480	79

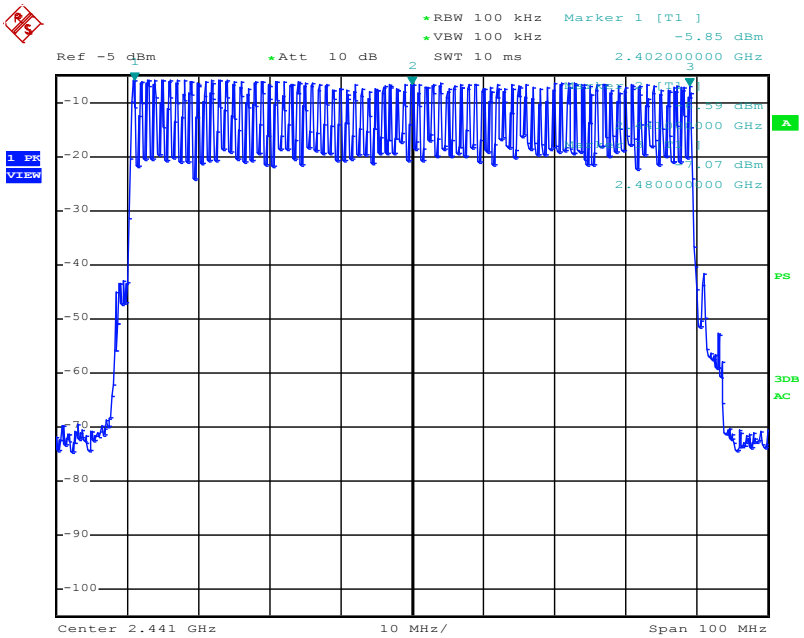
Limit according to FCC Part 15C, Section 15.247(1):

Frequency range (MHz)	LIMIT (Number of Hopping Channels)			
	20dB Bandwidth < 250kHz	20dB Bandwidth > 250kHz	20dB Bandwidth < 1 MHz	20dB Bandwidth > 1MHz
2400 – 2483,5	15	15	15	15

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocol.

4.13.3 Test protocol



4.14 Antenna application

4.14.1 Applicable standard

According to FCC Part 15C, Section 15.203:
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 that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has a integrated chip antenna; special tools are needed for replacing the antenna that prevents manipulation by a user. No external power amplifier can be connected. The requirements of part 15.203 and 15.204 are met.

4.14.2 Antenna requirements

According to FCC Part 15C, Section 15.247 (b)(4):
The conducted output power limit specified in paragraph (b) of 15.247 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 intentional radiator shall be reduced below the stated values in paragraph (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.

For the used antenna type, ALA3221C3, an output power reduction is not necessary.

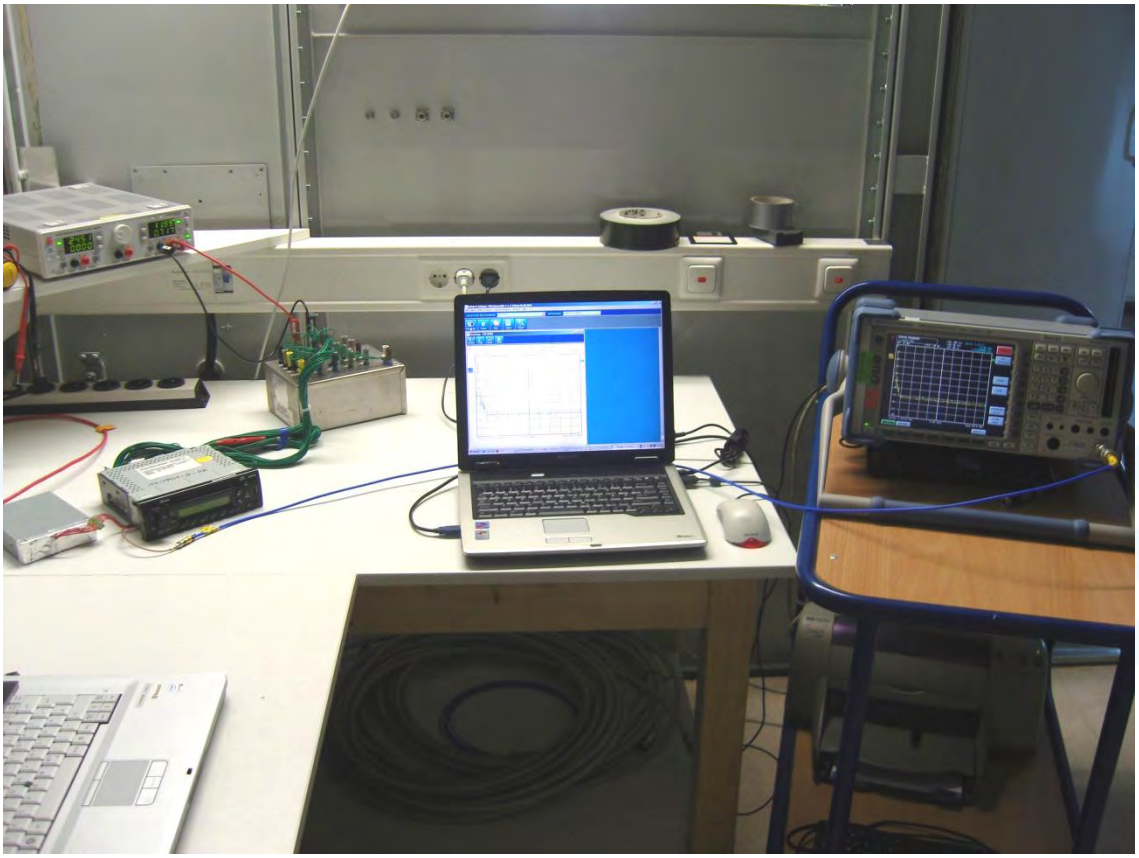
4.15 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

4.15.1 Description of the test location

Test location: AREA4

4.15.2 Photo documentation of the test set-up



4.15.3 Applicable standard

According to FCC Part 15, Section 15.247(i):
Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.
The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".
This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

4.15.4 Description of Measurement

The maximum total power input to the antenna is measured conducted as described in clause 5.3 of this document. To calculate the MPE in a defined distance away from the product the Friis transmission formula is used.

Friis transmission formula:

$$P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$$

Where
P_d = power density (mW/cm^2)
P_{out} = output power to antenna (mW)
G = gain of antenna (linear scale)
r = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user (r = 20 cm).

4.15.5 Test result

Worst case: Antenna type ALA3221C3 with an peak antenna gain of 2.3 dBi, Power setting: max

DH5

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
	(MHz)	(dBm)	(mW)	(dBi)	(mW/cm^2)	(mW/cm^2)
1	2402	-4.4	0.36	2.3	0.0001	1.0
40	2441	-4.4	0.36	2.3	0.0001	1.0
79	2480	-5.1	0.31	2.3	0.0001	1.0

2-DH5

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
	(MHz)	(dBm)	(mW)	(dBi)	(mW/cm^2)	(mW/cm^2)
1	2402	-5.1	0.31	2.3	0.0001	1.0
40	2441	-5.2	0.30	2.3	0.0001	1.0
79	2480	-5.6	0.28	2.3	0.0001	1.0

3-DH5

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
	(MHz)	(dBm)	(mW)	(dBi)	(mW/cm^2)	(mW/cm^2)
1	2402	-5.1	0.31	2.3	0.0001	1.0
40	2441	-5.2	0.30	2.3	0.0001	1.0
79	2480	-5.6	0.28	2.3	0.0001	1.0

Limits for maximum permissible exposure (MPE):

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/*f*	2.19/*f*	180/ f^2	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	*f*/1500	30
1500-100000	**---**	**---**	**1.0**	**30**

f = Frequency (MHz)

The requirements are **FULFILLED.**

Remarks:

4.16 Receiver conducted disturbances

For test instruments and accessories used see section 6 Part **A 4**.

4.16.1 Description of the test location

Test location: NONE

Remarks: For detailed test result please refer to following test protocols

4.17 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER2** and **SER3**.

4.17.1 Description of the test location

Test location: OATS1
Test location: Anechoic Chamber A2

Test distance: 3 metres

4.17.2 Photo documentation of the test set-up

Test setup 30 – 1000 MHz

Test setup 1 – 7.5 GHz

4.17.3 According to RSS-Gen, Section 6.1:

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. Spurious emissions from receivers shall not exceed the radiated limits shown in the table below.

4.17.4 Description of Measurement

Radiated emissions are measured according the requirements of ANSI C63.4. If the emission level in peak mode is lower as the average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

4.17.5 Test result

f < 1 GHz:

Channel 1

Frequency (MHz)	Level QP (dBµV)	Correct. factor (dB)	Corrected level QP dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
30 - 1000	-					

Channel 40

Frequency (MHz)	Level QP (dBµV)	Correct. factor (dB)	Corrected level QP dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
30 - 1000	-					

Channel 79

Frequency (MHz)	Level QP (dBµV)	Correct. factor (dB)	Corrected level QP dB(µV/m)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
30 - 1000	-					

Note: No emission could be detected up to 1000 MHz.

f > 1GHz:

Channel 1

Frequency (MHz)	L: PK (dBµV)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
1774	45.8	74.0	54.0	-28.2

Channel 40

Frequency (MHz)	L: PK (dBµV)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
1276	46.1	74.0	54.0	-27.9

Channel 79

Frequency (MHz)	L: PK (dBµV)	Limit PK dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
2662	46.4	74.0	54.0	-28.2

Limit according to RSS-Gen, Section 6.1 Table 2:

Frequency of emission (MHz)	Field strength limit (µV/m)	Field strength limit dB(µV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

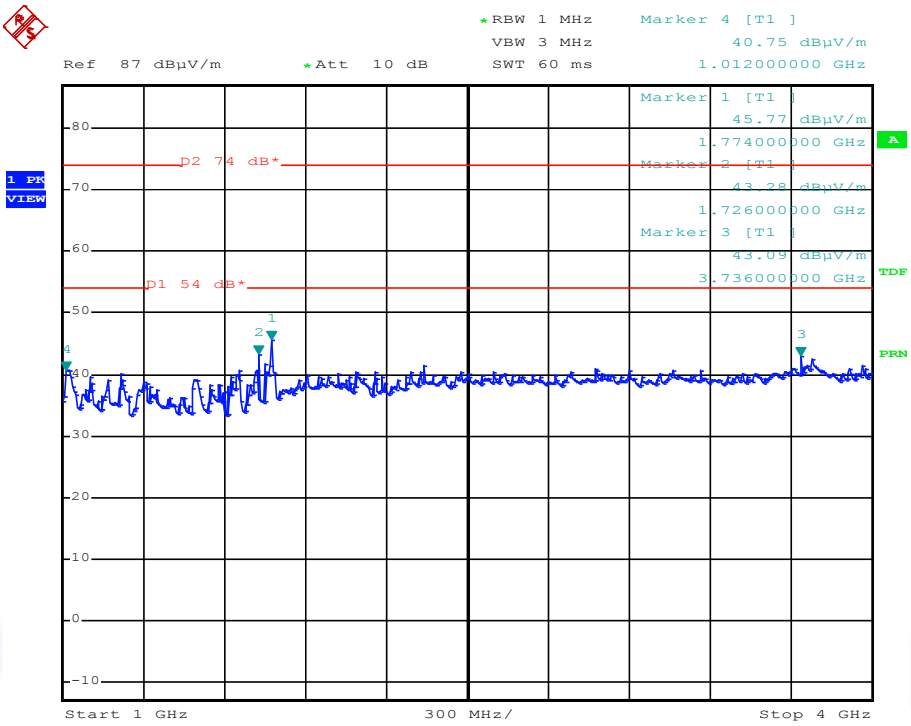
The requirements are **FULFILLED.**

Remarks: During the test, the EUT was set into continuous receiving mode. According to RSS-Gen 4.10 the measurement is performed up to the 3rd harmonic (7.5 GHz). For detailed test result please refer to following test protocol. Only the worst case plots are listed.

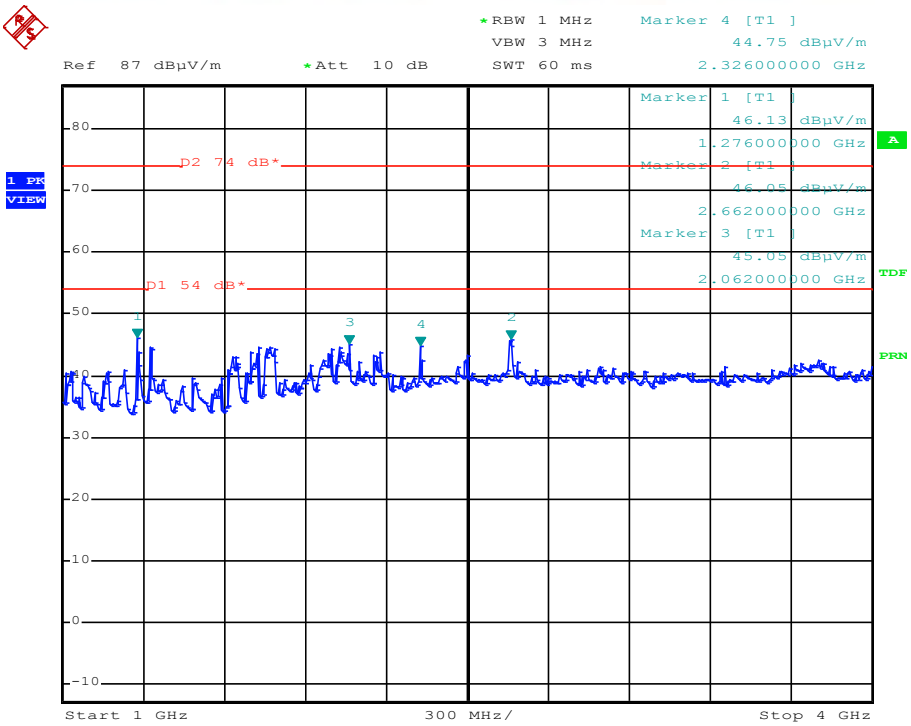
4.17.6 Test protocol

Receiver radiated emissions:

CH1, 1 - 4 GHz

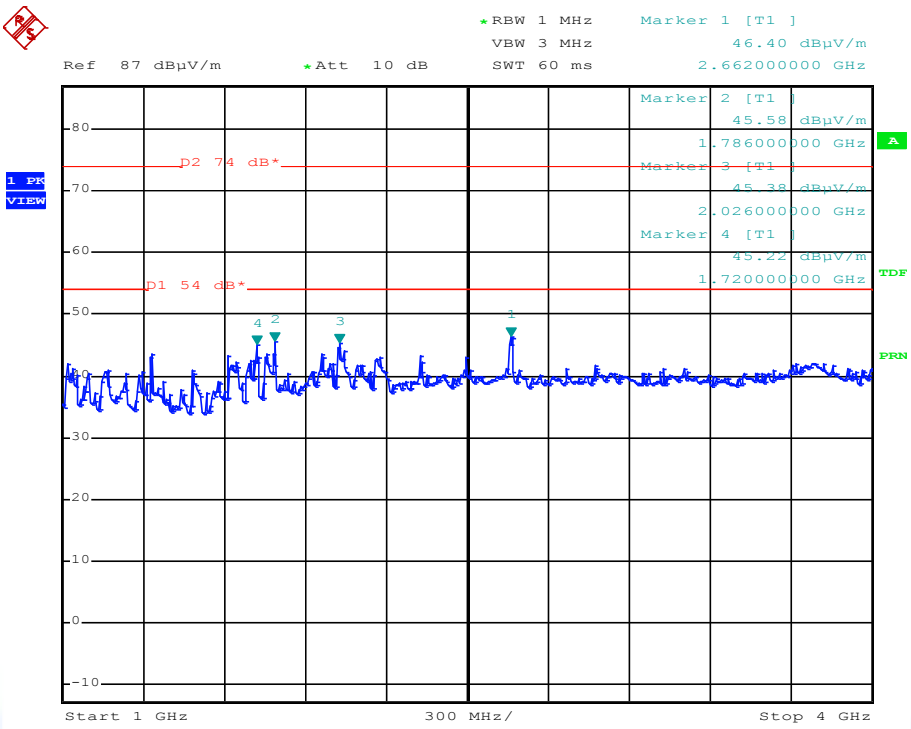


CH40, 1 - 4 GHz

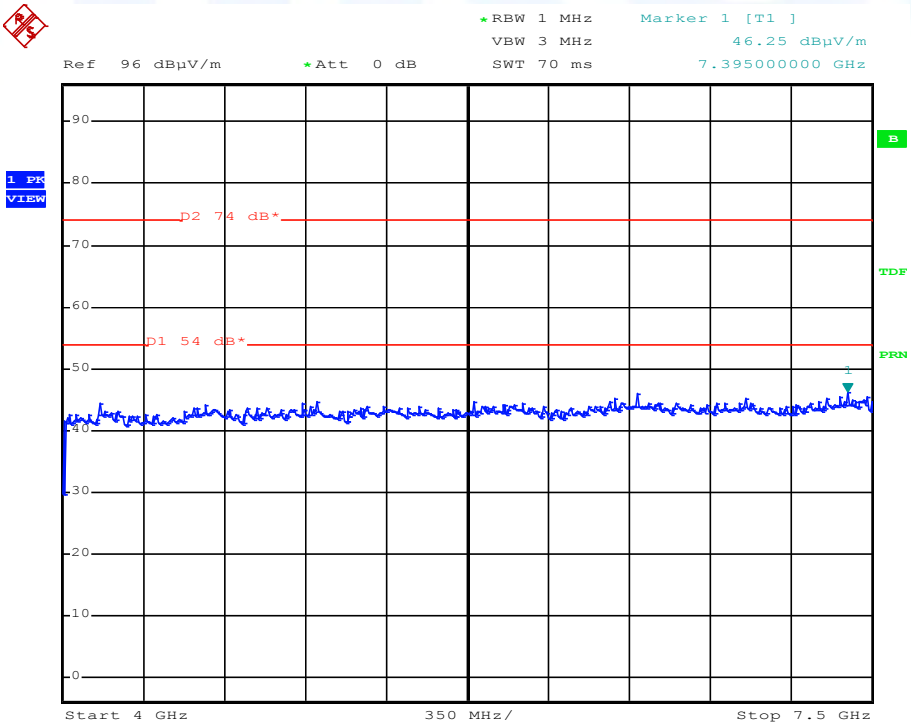


FCC ID:L2C0048TR

CH79, 1 - 4 GHz

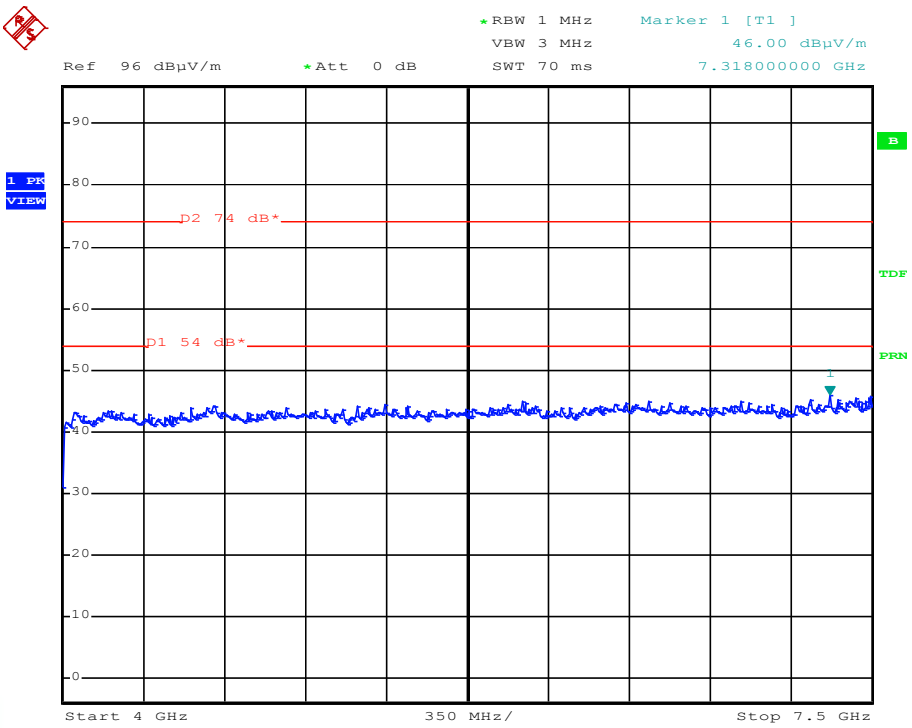


CH1, 4 – 7.5 GHz

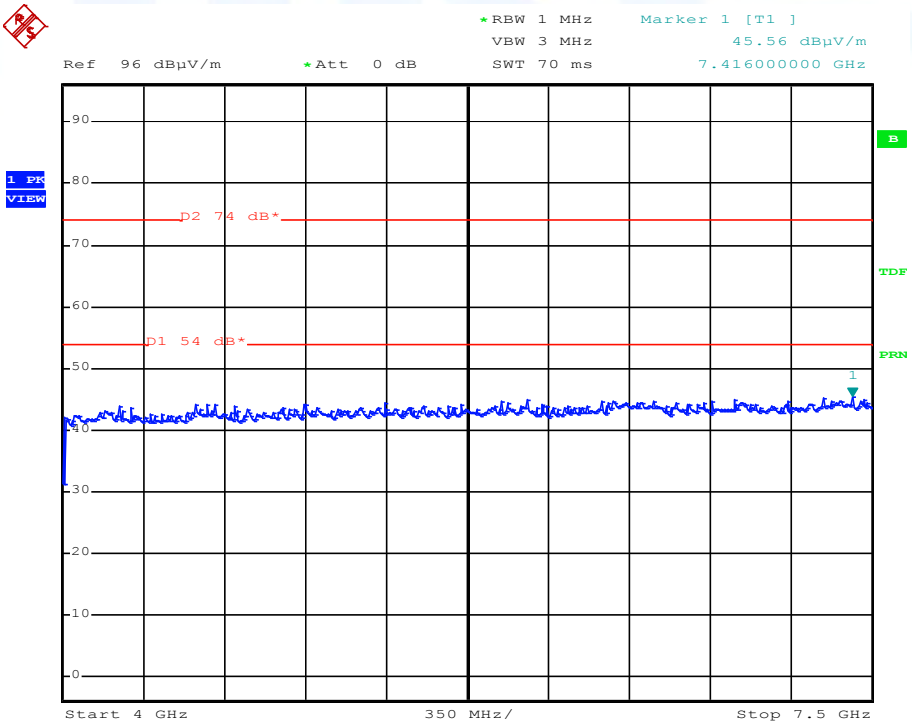


FCC ID:L2C0048TR

CH40, 4 – 7.5 GHz



CH79, 4 – 7.5 GHz



5 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPC 3	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	HM8143	02-02/50-10-016				
MB	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	HM8143	02-02/50-10-016				
SEC 1-3	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	HM8143	02-02/50-10-016				
SER 2	ESVS 30	02-02/03-05-006	20/06/2012	20/06/2011		
	VULB 9168	02-02/24-05-005	07/03/2012	07/03/2011	17/09/2011	17/03/2011
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	17/05/2012	17/05/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	11/02/2012	11/02/2011		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	VLP-1405 PRO	02-02/50-10-014				