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RTTE AND AUTOMOTIVE COMPONENTS LABORATORY

TEST REPORT
No. ARSM00136/1

performed in accordance with

FCC Rules: Code of Federal Regulations (CFR) no. 47
Part 15 Subpart C Section 15.247

PRODUCT	Wireless probe for EMG system
MODEL(s) TESTED	BTSWEMG2
FCC ID	YQH-BTSWEMG2
TRADE MARK(s)	BTS

APPLICANT	BTS S.p.A. – Viale Forlanini, 40 – I-20024 Garbagnate Milanese (MI)

Tested by	Robertino Torri	Robertino Torri
Approved by	Giorgio Belussi *[Laboratory head]*	

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2013-01-18	First edition
Rev. 1	2013-06-21	Updating: name of model tested, graphs pag 11 and 13; pag. 16 insert results for receiver, pag. 21 modified "Calculated" with "Measured" and § 7.8.

1. GENERAL DATA

SAMPLE		
Samples received on	**2012-12-20**	**(item sent and sampling by applicant)**
IMQ reference samples	**BEM**	**66684**
Samples tested No.	1	
Object under analysis recognition	**Not carried out** Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
TEST LOCATION		
Testing dates	2012-12-20 ÷ 2013-01-16	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Viale Lombardia, 20 – I-20021 Bollate (MI)	
ENVIRONMENTAL CONDITIONING		
Parameter	***Measured***	
Ambient Temperature	25 ÷ 35 °C	
Relative Humidity	50 ÷ 60 %	
Atmospheric Pressure	900 ÷ 1000 mbar	

2. REFERENCE DOCUMENT

DOCUMENT		DATE	TITLE
☒	47 CFR Part 15	2008	Radio Frequency Device
☒	ANSI C63.4	2009	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
☒	ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices

3. UNIT UNDER TEST (EUT) DETAILS

GENERAL DATA

MODEL (basic)	Description
BTSWEMG2	Wireless probe for EMG system
VARIANTS (derived)	**Description**
/	/

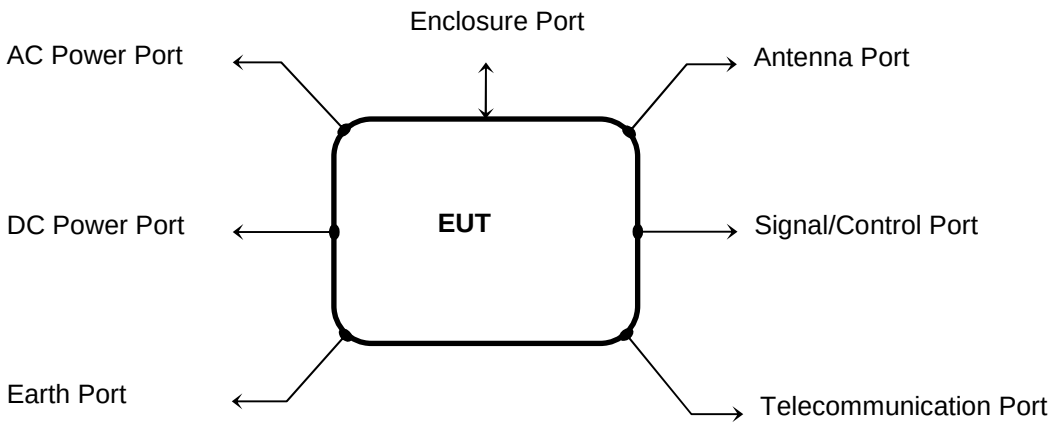
FCC ID	BTS S.p.A. – Viale Forlanini, 40 – I-20024 Garbagnate Milanese (MI)

Manufacturer	

Type of equipment	Wireless EMG probe for EMG system
Operating frequency:	2405 ÷ 2480 MHz
Maximum RF radiated power:	-6.55 dBm
Modulation:	DTS
Channel Spacing:	5 MHz
Antenna:	Integral antenna
RX sensitivity:	/
Main SW identification	/
Main HW Board identification	/
Peripherals included (for system application)	/
Interfaces :	/
Integrated interfaces :	/
AC adapter:	AC/DC power supply XP Power model VEP24US09 + Docking station BTS model BTSFE3CHG

4. TEST CONFGURATION OF UNIT UNDER TEST

EUT PORTS



Port	Description	Max length
Enclosure	Plastic and metal	/
AC power	/	/
DC power	3.7 V DC dedicated lithium battery pack	/
Earth	/	/
Telecommunication	/	/
Signal	/	/
Control	/	/
Antenna	Integral	/

CHANNEL CONFIGURATION

Channel (No.)	Frequency (MHz)
11	2405
12	2410
13	2415
14	2420
15	2425
16	2430
17	2435
18	2440

Channel (No.)	Frequency (MHz)
19	2445
20	2450
21	2455
22	2460
23	2465
24	2470
25	2475
26	2480

STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Continuous transmission (single channel transmission)

SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
Acquisition unit	BTS	BTS FREEEMG 300

ELECTROMAGNETICALLY RELEVANT COMPONENTS

Component	No.	Manufacturer	Model
Main board with RF module	1	BTS	PRO-P0 EMG-02
Antenna board	1	BTS	PRO-P0-EMGANT-03

RFI SUPPRESSION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EMI PROTECTION DEVICES

Component	No.	Manufacturer	Model
/	/	/	/

EUT TECHNICAL DOCUMENTATION

Document	Reference
User manual	BTSFREEMG300 version 4.0.0

5. METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2009, ANSI C63.10-2009 and Section 15.31 of CFR47 Part 15 – Subpart A (General). Additional test requirements have been adopted according to the reference Section indicated in the § 6 of this test report.
FREQUENCY RANGE INVESTIGATED
Radiated emission tests: from 9 kHz to tenth harmonic of fundamental.

6. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object does meet the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

CFR47 Part 15	TITLE	RESULT
§ 15.203 § 15.247 (b)(4)(i)	Antenna Requirements	PASS
§ 15.207 (a)	Conducted Emission	PASS [1]
§ 15.209 (a) (f)	Radiated Emission	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	N.A. [2]
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	N.A. [2]
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	N.A. [2]
§ 15.247(a)(1)(iii)	Time occupancy (Dwell Time) of Each Ch. within a 0,4 x Nch (sec) Period	N.A. [2]
§ 15.247(a)(2)	6dB Minimum Bandwidth	PASS
§ 15.247(b)	Maximum Peak Output Power	
§ 15.247(b) (1)	Peak Output Power	N.A.
§ 15.247(b) (3)	RF power output, radiated (EIRP)	PASS
§ 15.247(b) (4)	Antenna gain	N.A.
§ 15.247(c)	Operation with directional antenna gains greater than 6 dBi	N.A.
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (d)	Conducted Emission	PASS
§ 15.247 (e)	Power Spectral Density	PASS
§ 15.247 (f)	Hybrid systems	N.A. [2]
§ 15.247 (g)	FHSS Transmission characteristics	N.A. [2]
§ 15.247 (h)	Recognition of occupied channel and multiple transmission system	N.A. [2]
§ 15.247(i) (§ 47CFR 1.1307(b)(1))	RF humane exposure	PASS

Note 1	The test has been carried out on AC/DC adapter of dedicated probe recharging docking station
Note 2	Not applicable for DTS equipment

7. TEST RESULTS

7.1 ANTENNA REQUIREMENTS

TEST 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 Sections 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 Section 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.

Antenna specifications	
N° of authorized antenna types	Not Applicable
Antenna type	Integral antenna
Maximum total gain	----
External power amplifiers	Not present

TEST RESULT
The EUT meets the requirements of section 15.203 and 15.204

7.2 CONDUCTED EMISSION

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Shielded chamber
Test distance	3 meters
Frequency range	150 kHz – 30 MHz
IF bandwidth	9 kHz
EMC class	B
EUT operating condition	#1

LIMITS

Band of operations	Quasi-Peak (dBµV)	Average Limit (dBµV)
0.15 ÷ 0.5	66 ÷ 56	56 ÷ 46
0.5 ÷ 5	56	46
5 ÷ 30	60	50

TEST RESULT

The EUT meets the requirements of sections 15.207 (a).

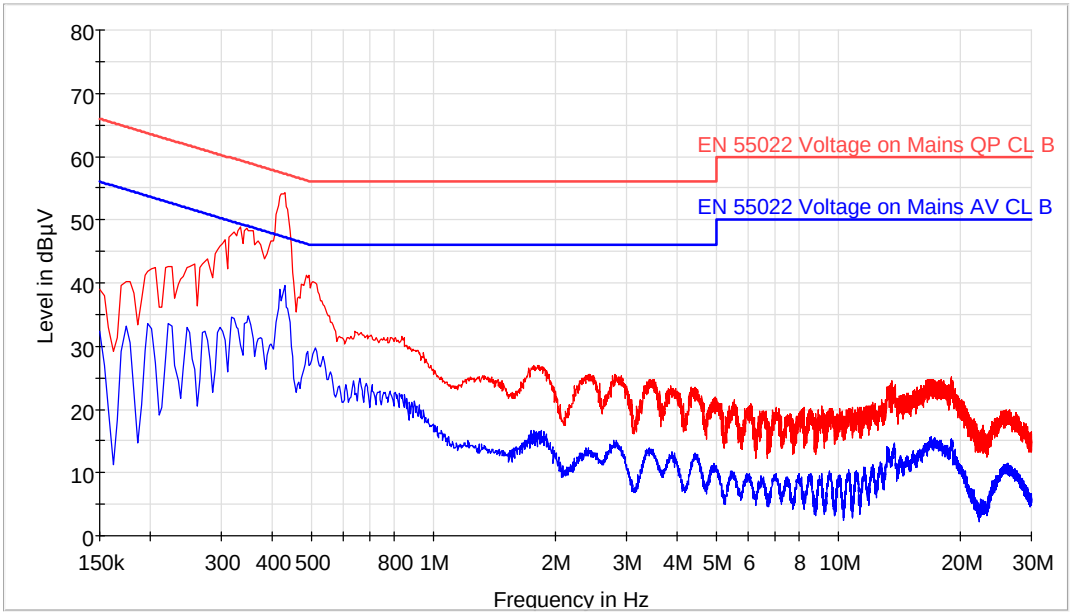
TEST PROCEDURE

1) The EUT was placed on a wooden table of size, 80 cm by 80 cm, raised 80 cm in which is located 40 cm away from the vertical wall the shielded room.
2) Each EUT power cord input cord was individually connected through a 50Ω/50µH LISN to the input power source.
3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 10 kHz during the measurements.
6) The measurements with Quasi-Peak detector are performed only for frequencies for which the Peak values are ≥ (Q.P. limit - 6 dB).

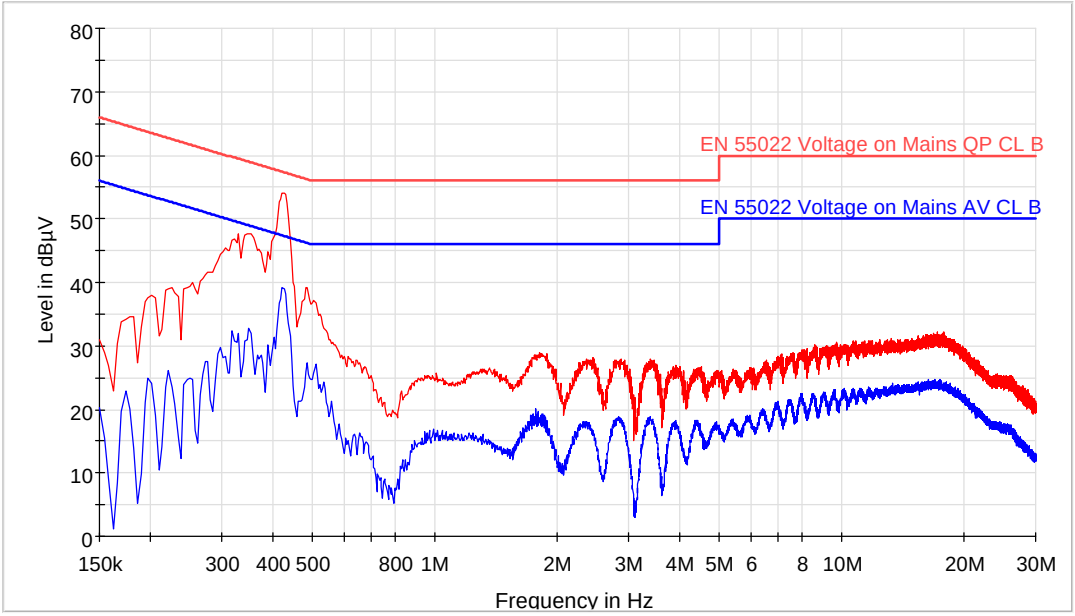
MEASUREMENTS RESULTS

Conducted disturbance on AC/DC adapter mains power port of docking station for probe recharging

150 kHz÷30 MHz – PHASE LINE



150 kHz÷30 MHz – NEUTRAL LINE



7.3 RADIATED DISTURBANCES

TEST REQUIREMENT	
Test setup	ANSI C63.4
Test facility	Semi-anechoic chamber
Test distance	3 meters
Frequency range	9 kHz to tenth harmonic of fundamental
IF bandwidth (below 30 MHz)	9 kHz
IF bandwidth (below 1,000 MHz)	120 kHz
IF bandwidth (above 1,000 MHz)	1 MHz
EMC class	B
EUT operating condition	#1
Remark	In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = 40log (300meter / 3meter) = +80db Extrapolation (dB) = 40log (30meter / 3meter) = +40db

LIMITS

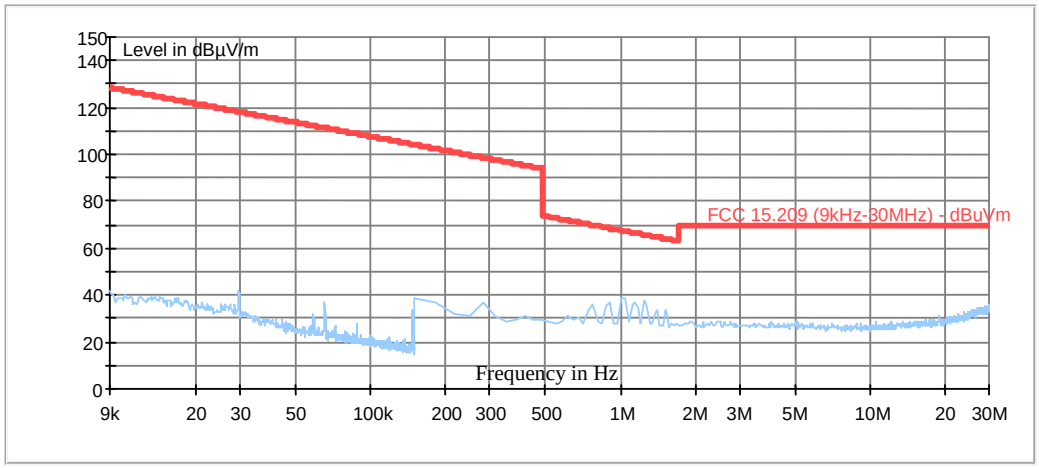
Band of operations	Peak (dBµV/m)	Average Limit (dBµV/m)
Restricted bands (par. 15.205)	74	54
Other bands	According to 15.209 or fundamental –20dB (which is greater)	According to 15.209 or fundamental –20dB (which is greater)

TEST PROCEDURE

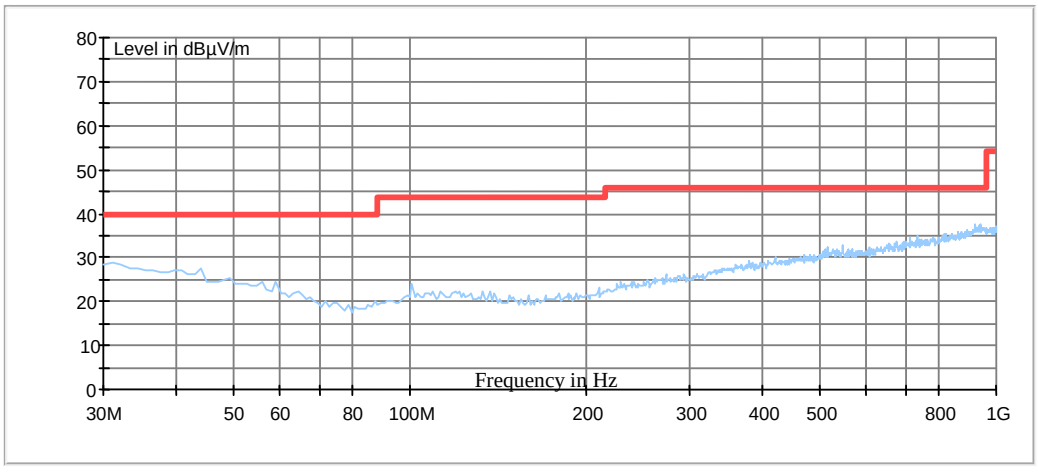
1) The EUT was placed on turntable which is 0.8 m above the ground plane
2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100 kHz below 1000 MHz and 1 MHz above 1000 MHz.
5) The receiving antenna was positioned in both horizontal and vertical polarization.
6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are ≥ (Q.P. limit - 6 dB).

MEASUREMENTS RESULTS

9 kHz÷30 MHz



30÷1,000 MHz



Channel n°11: 2,405 MHz

PEAK RESULT (RBW=1MHz; VBW=1MHz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µV/meter)**	**Limit (dBµV/m)**	**Margin(dB)**
2,405 (fundamental)	91.26	---	---	---
4,810	48.56	5000	74.00	-25.44
7,216	54.02	5000	74.00	-19.98
f> 7,216	No spurious detected	5000	74.00	---

AVERAGE FACTOR			
T. Pulse (ms)	**TX on + TX off (ms)**	**Duty cycle**	**Average Factor (dB)**
/	/	100 %	/

AVERAGE RESULT (RBW=1MHz; VBW=10Hz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µVolt/meter)**	**Limit (dBµV/m)**	**Margin (dB)**
2,405 (fundamental)	90.05	---	---	---
4,810	42.38	500	54	-11.64
7,216	45.32	500	54	-8.68
f> 7,216	No spurious detected	500	54	---

Channel n°18: 2,440 MHz

PEAK RESULT (RBW=1MHz; VBW=1MHz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µV/meter)**	**Limit (dBµV/m)**	**Margin(dB)**
2,440 (fundamental)	90.05	---	---	---
4,880	49.60	5000	74.00	-24.40
7,320	52.08	5000	74.00	-21.92
f> 7,320	No spurious detected	5000	74.00	---

AVERAGE FACTOR			
T. Pulse (ms)	**TX on + TX off (ms)**	**Duty cycle**	**Average Factor (dB)**
/	/	100 %	/

AVERAGE RESULT (RBW=1MHz; VBW=10Hz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µVolt/meter)**	**Limit (dBµV/m)**	**Margin (dB)**
2,440 (fundamental)	89.41	---	---	---
4,880	41.66	500	54	-12.34
7,320	41.24	500	54	-12.76
f> 7,320	No spurious detected	500	54	---

Channel n°26: 2,480 MHz

PEAK RESULT (RBW=1MHz; VBW=1MHz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µV/meter)**	**Limit (dBµV/m)**	**Margin(dB)**
2,480 (fundamental)	89.38	---	---	---
4,960	48.95	5000	74	-25.05
7,440	44.45	5000	74	-29.55
f> 7,440	No spurious detected	5000	74	---

AVERAGE FACTOR			
T. Pulse (ms)	**TX on + TX off (ms)**	**Duty cycle**	**Average Factor (dB)**
/	/	100 %	/

AVERAGE RESULT (RBW=1MHz; VBW=10Hz)				
Frequency (MHz)	**Measured Level (dBµV/m)**	**Limit (µVolt/meter)**	**Limit (dBµV/m)**	**Margin (dB)**
2,480 (fundamental)	88.52	---	---	---
4,959	45.83	500	54	-8.17
7,440	29.12	500	54	-24.88
f> 7,320	No spurious detected	500	54	---

TEST RESULT

The EUT has been tested in 3 orthogonal axes and the results presented are worst case.

The measurement of spurious emission of EUT in receiver mode is deemed to be fulfilled as no limits are exceeded in transmitter mode (condition considered more burdensome).

The EUT meets the requirements of sections 15.205 (b), 15.209 and 15.247.

7.3 6 dB BANDWIDTH

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	2 MHz
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	2,5 ms
Detector function	Peak
Trace	max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

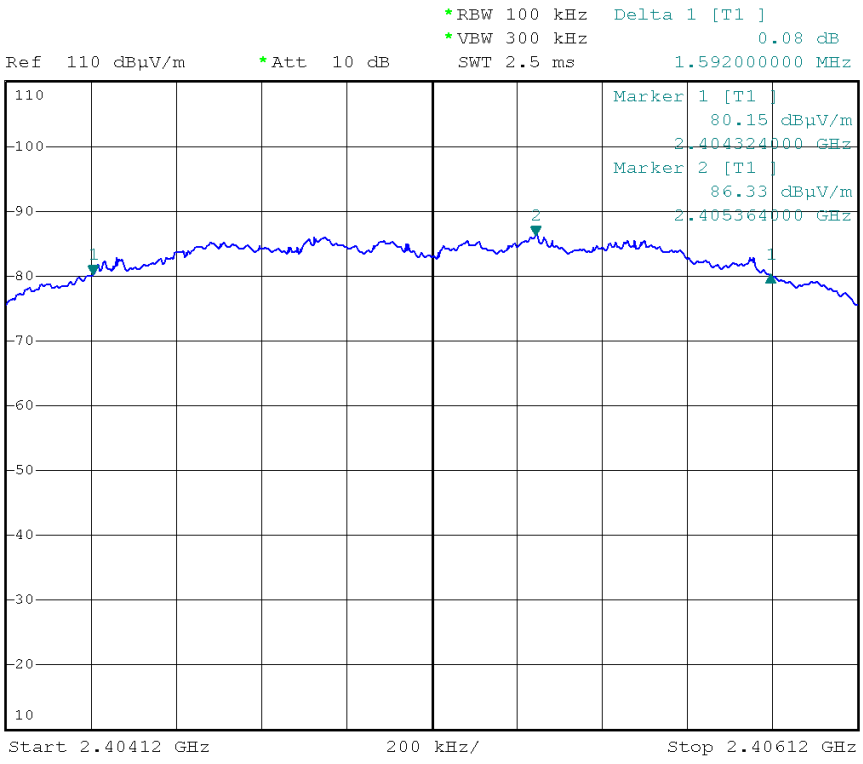
TEST RESULT
The EUT meets the requirements of sections 15.247 (a) (2)

TEST PROCEDURE
The EUT is set to transmit has its maximum data rate. The Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

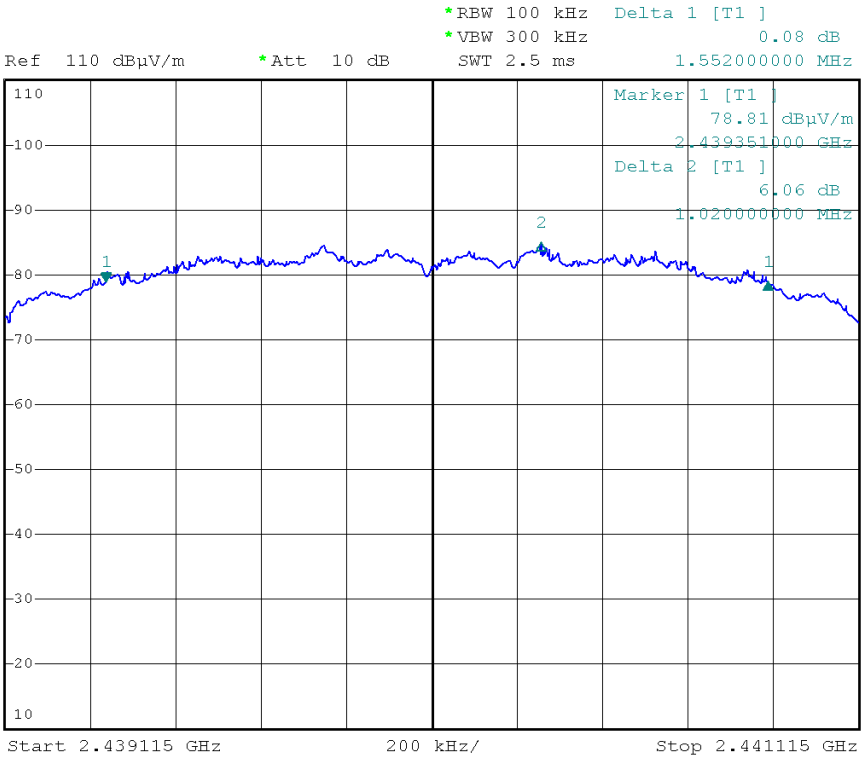
MEASUREMENTS RESULTS

Channel (No.)	Frequency (MHz)	Channel Bandwidth (MHz)	Plot (No.)
11	2,405	1.592	1
18	2,440	1.552	2
26	2,480	1.612	3

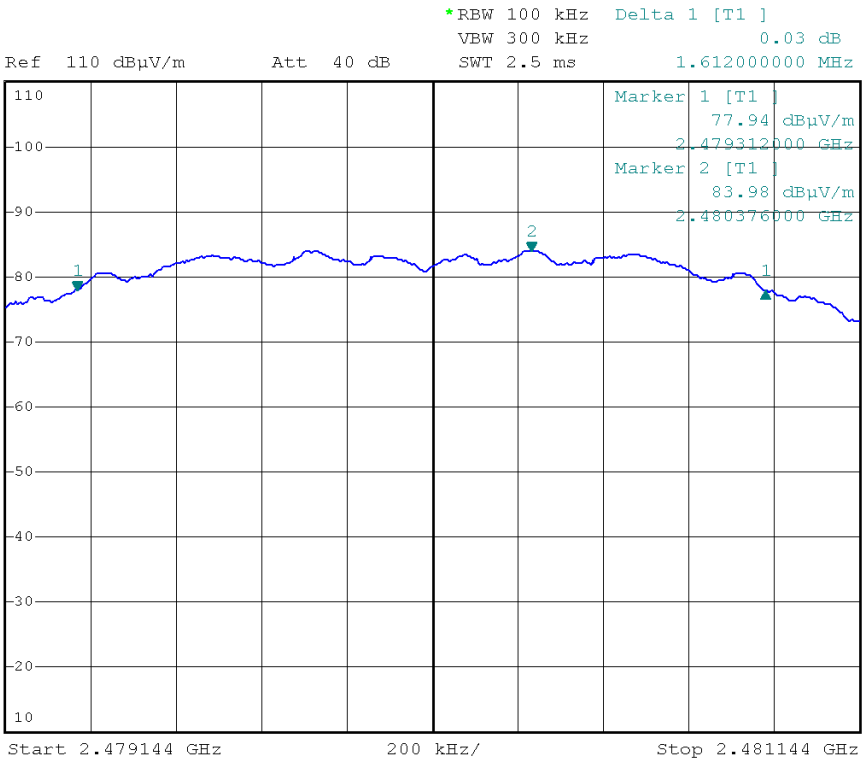
Plot 1



Plot 2


*RBW 100 kHz
*VBW 300 kHz
Ref 110 dBµV/m
*Att 10 dB
SWT 2.5 ms
Delta 1 [T1]
0.08 dB
1.552000000 MHz
Marker 1 [T1]
78.81 dBµV/m
2.439351000 GHz
Delta 2 [T1]
6.06 dB
1.020000000 MHz
110
100
90
80
70
60
50
40
30
20
10
Start 2.439115 GHz
200 kHz/
Stop 2.441115 GHz

Plot 3


*RBW 100 kHz
VBW 300 kHz
Ref 110 dBµV/m
Att 40 dB
SWT 2.5 ms
Delta 1 [T1]
0.03 dB
1.612000000 MHz
Marker 1 [T1]
77.94 dBµV/m
2.479312000 GHz
Marker 2 [T1]
83.98 dBµV/m
2.480376000 GHz
110
100
90
80
70
60
50
40
30
20
10
Start 2.479144 GHz
200 kHz/
Stop 2.481144 GHz

7.4 MAXIMUM PEAK OUTPUT POWER WITH EXTERNAL ANTENNA (DE FACTO EIRP)

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	/
Resolution bandwidth (RBW)	10 MHz
Video bandwidth (VBW)	10 MHz
Sweep time (SWT)	2,5 ms
Detector function	Peak
Trace	max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

TEST RESULT
The EUT meets the requirements of sections 15.247 (b) (3)

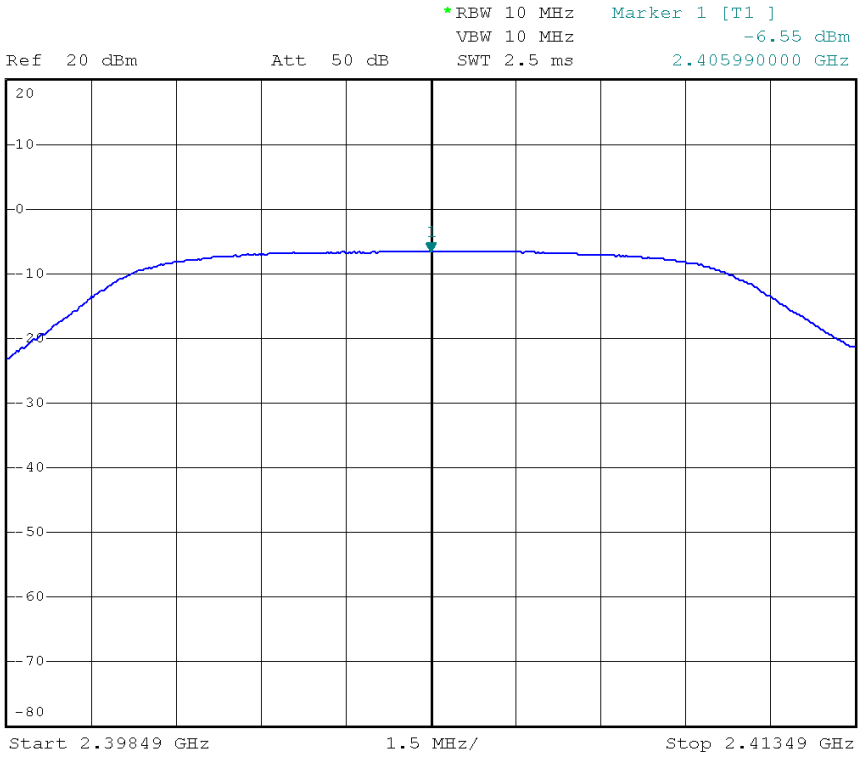
LIMITS
1 Watt (30dBm)

TEST PROCEDURE
Conducted measurements:
The transmitter output was connected to the spectrum analyzer through a temporary RF 50Ω connector type SMA.
Radiated measurements:
As the EUT is supplied with a dedicated antenna, the effective radiated power is measured in a 3 m anechoic chamber with the substitution antenna method

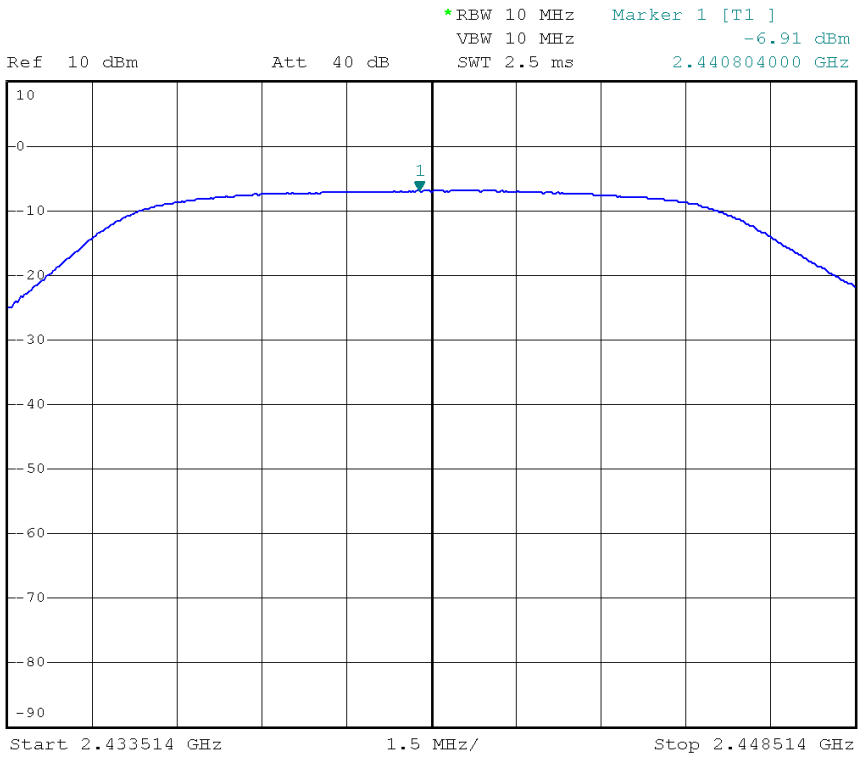
MEASUREMENTS RESULTS (RADIATED)

Channel (No.)	Frequency (MHz)	Measured Output Power (dBm)	Max. Antenna Gain (dB)	Measured Radiated Output Power (dBm)
11	2,405	/	/	-6.55
18	2,440	/		-6.91
26	2,480	/		-7.59

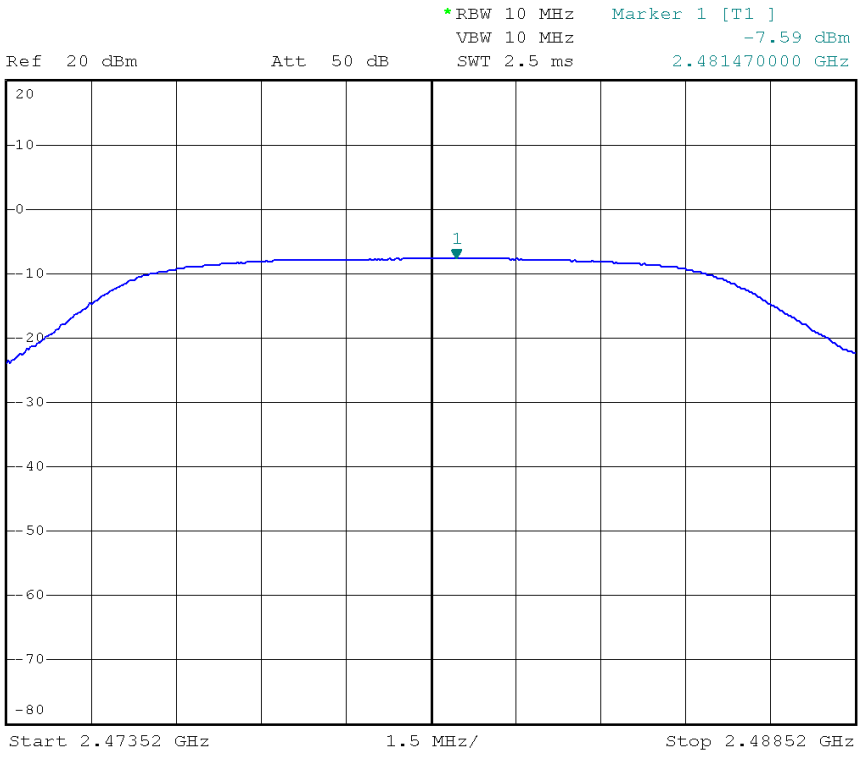
Plot 1



Plot 2


*RBW 10 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-6.91 dBm
2.440804000 GHz
Ref 10 dBm
Att 40 dB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1
Start 2.433514 GHz
1.5 MHz/
Stop 2.448514 GHz

Plot 3


*RBW 10 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-7.59 dBm
2.481470000 GHz
Ref 20 dBm
Att 50 dB
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
Start 2.47352 GHz
1.5 MHz/
Stop 2.48852 GHz

7.5 BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	Wide enough to capture 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
Resolution bandwidth (RBW)	1 MHz (100 kHz band-edge)
Video bandwidth (VBW)	1 MHz (100 kHz band-edge)
Sweep time (SWT)	Auto
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

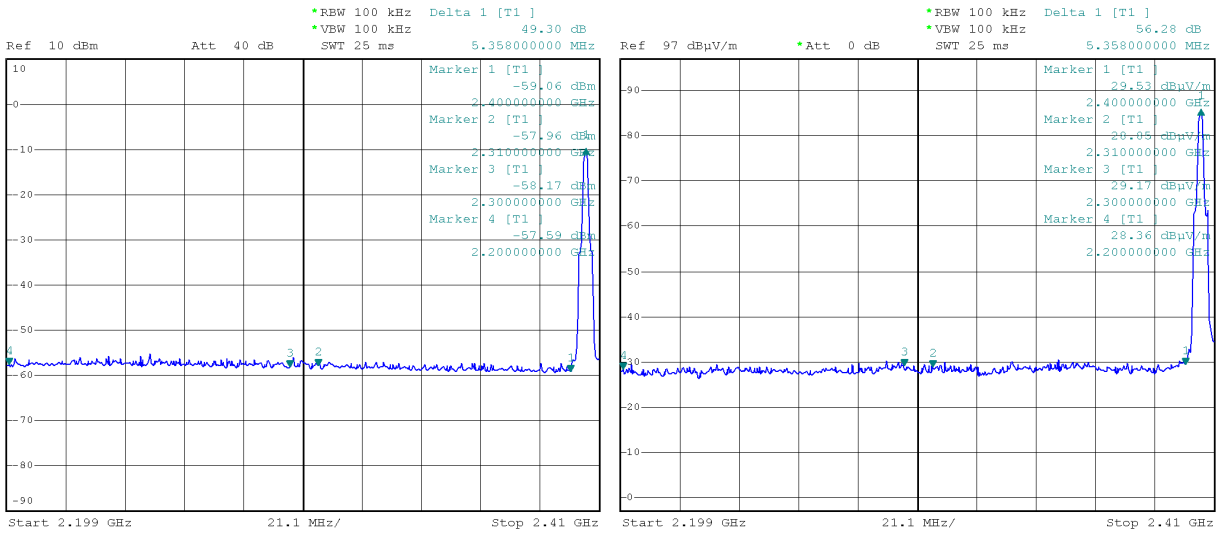
TEST RESULT
The EUT meets the requirements of sections 15.247 (d) All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

LIMITS
-20 dB below peak output power

TEST PROCEDURE
Only for measuring emissions up to 2 MHz removed from the band-edge the "delta" technique for Radiated emissions was used. Delta technique: The transmitter output was connected to the spectrum analyzer through a test fixture (radio frequency coupling device associated with the dedicated antenna of the equipment under test) Once the trace is stabilized, by the marker the emission at the band edge (or on the highest modulation product outside of the band, if this level is greater than that at the band edge) was set. The “n” by the marker-delta function and the marker-to-peak function the peak of the in-band emission was selected. The marker-delta value displayed was compared with the limit specified in this Section

MEASUREMENTS RESULTS

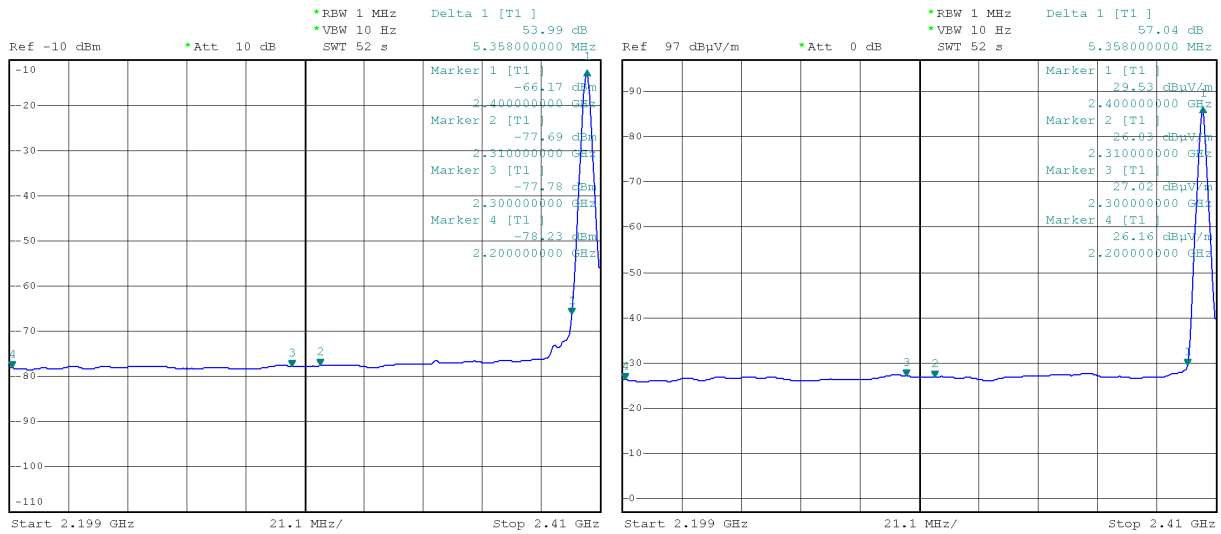
Band-edge compliance, lower band edge, (Peak)



Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
-9,76	-56.00	-46.24	-29.76	-26.24

Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
29.17	5000	74.00	-44.83

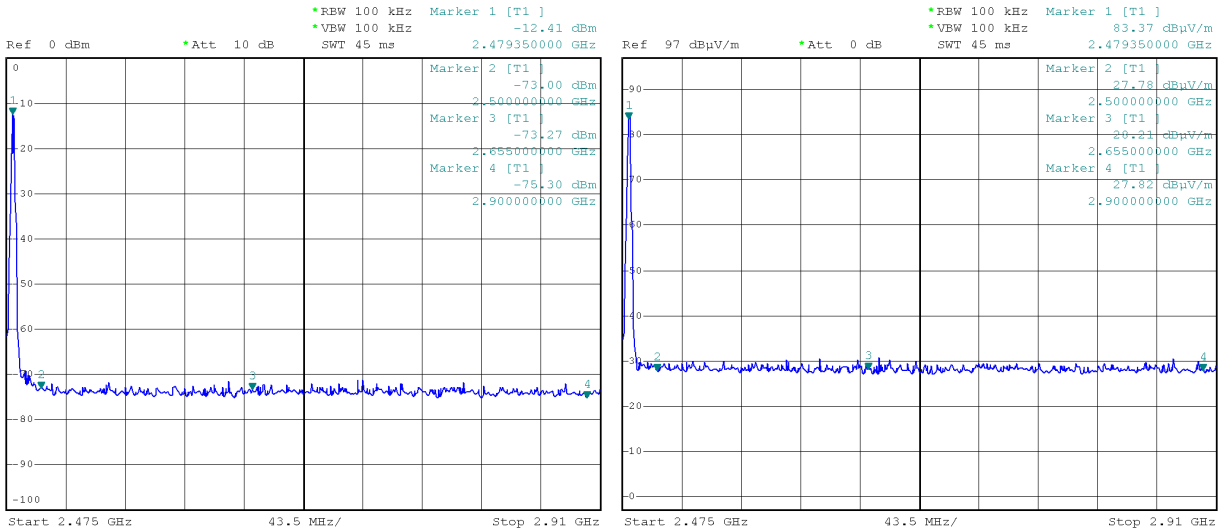
Band-edge compliance, lower band edge, (Average)



Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
-12.18	-77.69	-65.51	-32.18	-45.51

PK level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
27.02	500	54.00	-26.98

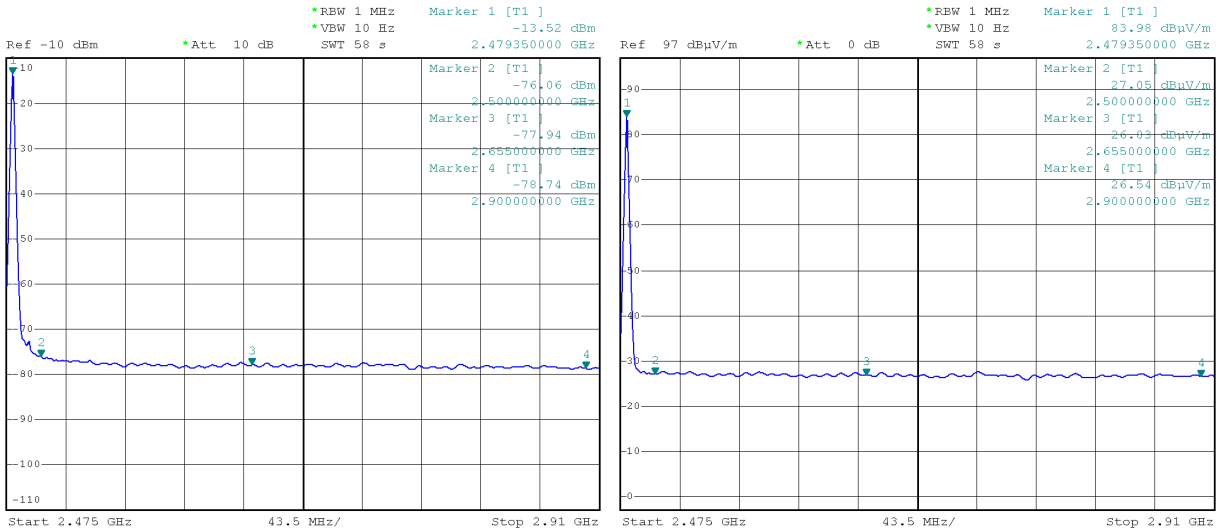
Band-edge compliance, upper band edge, (Peak)



Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
-12.41	-72.00	-59.59	-32.41	-39.59

Measured Level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
30.05	5000	74.00	-43.95

Band-edge compliance, upper band edge, (Average)



Measured power (dBm)	Measured power at the band edge (dBm)	Difference Peak – band edge (dBm)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
-13.52	-76.06	-62.54	-33.52	-42.54

PK level (dBµV/m)	Limit (µVolt/meter)	Limit (dBµV/m)	Margin (dB)
27.02	500	54.00	-26.98

7.6 CONDUCTED EMISSIONS OUTSIDE THE BAND 2,400-2,483.5 MHz

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	/
Resolution bandwidth (RBW)	100 kHz
Video bandwidth (VBW)	300 kHz
Sweep time (SWT)	as necessary to capture the entire dwell time
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

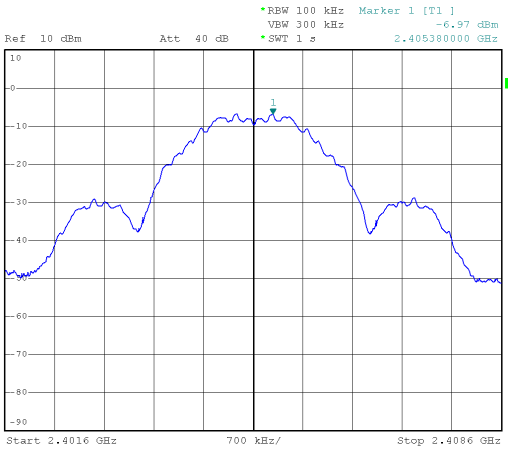
TEST RESULT
The EUT meets the requirements of sections 15.247 (d) All out of band spurious emissions are more 20 dB below the in band power of the fundamental.

LIMITS
-20 dB below peak output power

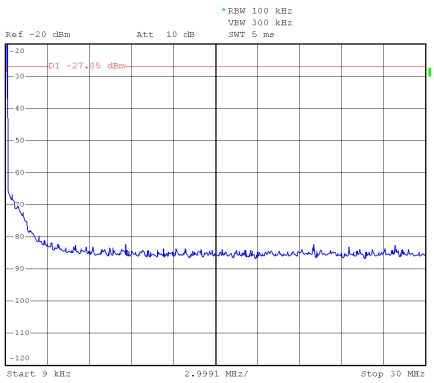
TEST PROCEDURE
The transmitter output was connected to the spectrum analyzer through a temporary RF 50Ω connector. The measure has been executed with the lowest transmit channel, the highest transmit channel and one located somewhere in the middle of the band.

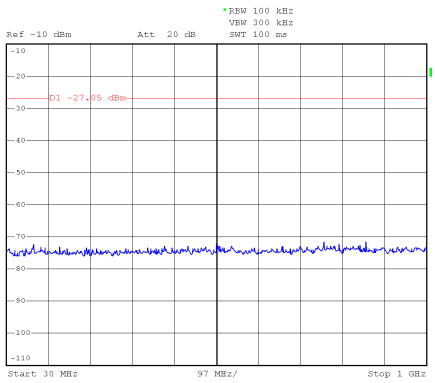
MEASUREMENTS RESULTS

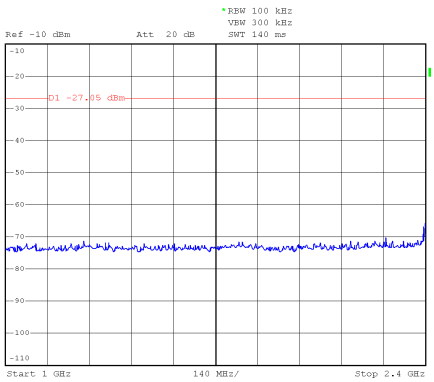
Channel 11 : Power for determination limit line

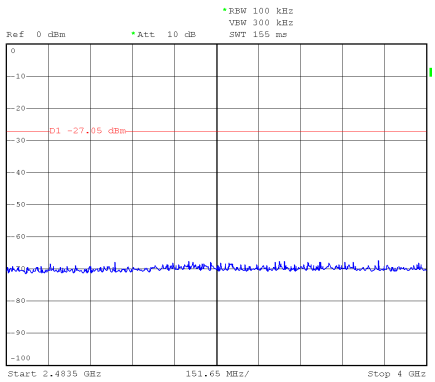


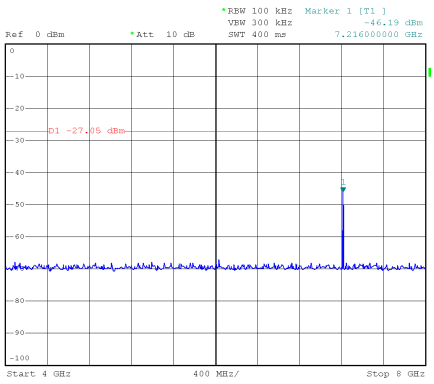
Conducted measure (channel 11)

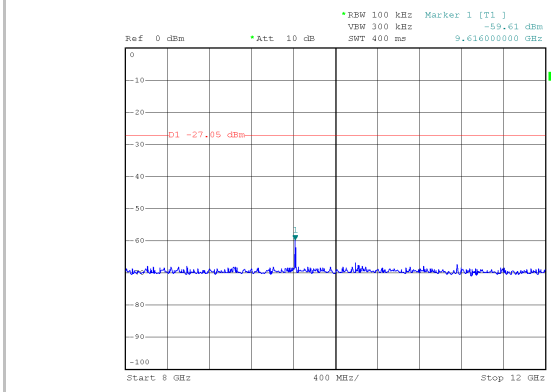


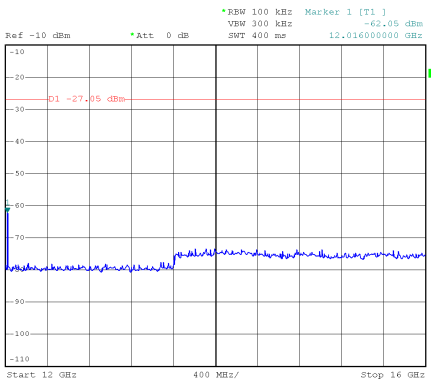


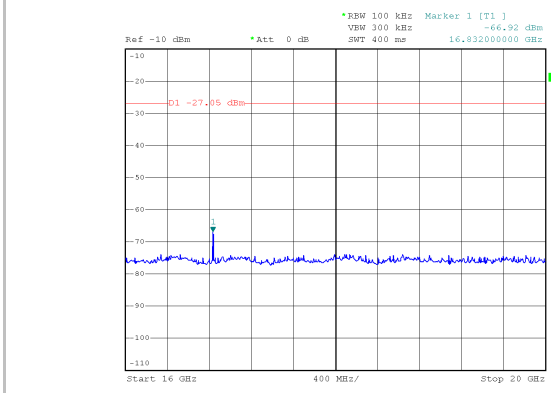


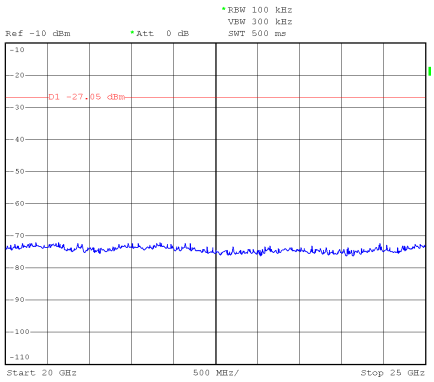



RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-46.19 dBm
7.216000000 GHz
Ref 0 dBm
Att 10 dB
D1 -27.05 dBm
Start 4 GHz
400 MHz/
Stop 8 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-59.61 dBm
9.616000000 GHz
Ref 0 dBm
Att 10 dB
D1 -27.05 dBm
Start 8 GHz
400 MHz/
Stop 12 GHz

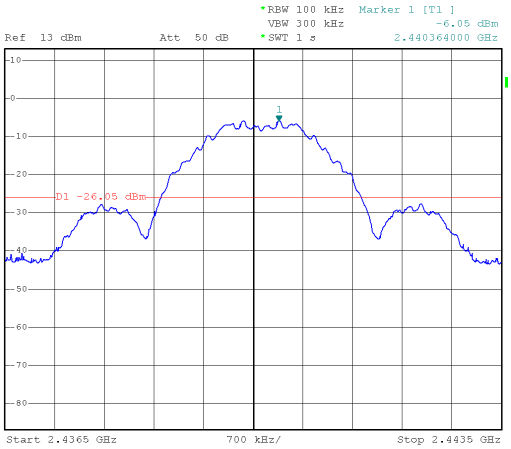

RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-62.05 dBm
12.016000000 GHz
Ref -10 dBm
Att 0 dB
D1 -27.05 dBm
Start 12 GHz
400 MHz/
Stop 16 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-66.92 dBm
16.832000000 GHz
Ref -10 dBm
Att 0 dB
D1 -27.05 dBm
Start 16 GHz
400 MHz/
Stop 20 GHz

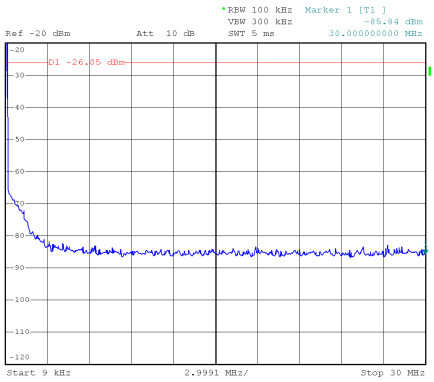

RBW 100 kHz
VBW 300 kHz
SWT 500 ms
Ref -10 dBm
Att 0 dB
D1 -27.05 dBm
Start 20 GHz
500 MHz/
Stop 25 GHz

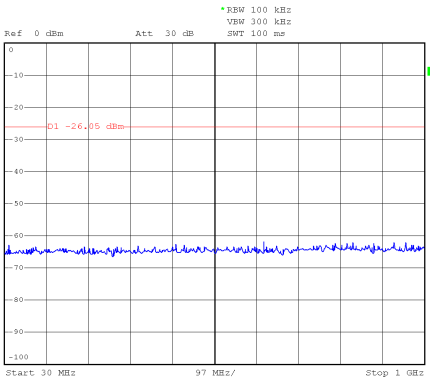
PEAK RESULT Channel n°11: 2,405.00 MHz				
Frequency (MHz)	**Measured Level (dBm)**	**Limit (dBm) Fundamental value – 20dB**	**Limit (dBm) Restricted band - 33dBm**	**Margin (dB)**
2,405 (fundamental)	-6.97	---	---	---
4,812	-34.87	---	-33	-1.87
7,216	-46.19	-26.97	---	-19.22
9,616	-59.61	-26.97	---	-32.64
12,016	-62.05	---	-33	-29.05
16,842	-57.93	-26.97	---	-30.96

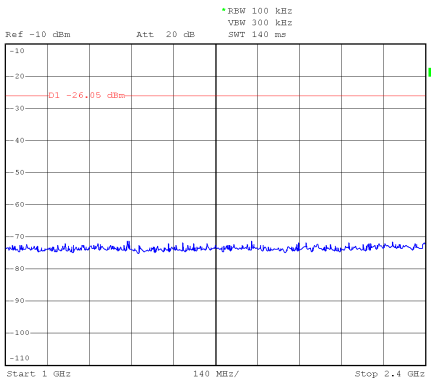
Channel 18 : Power for determination limit line

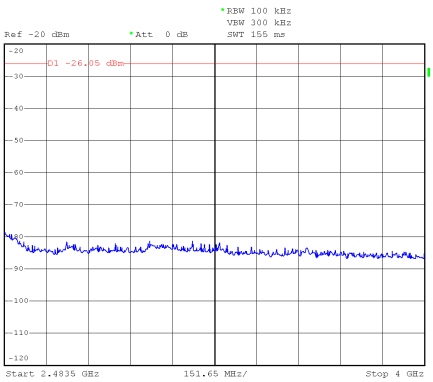


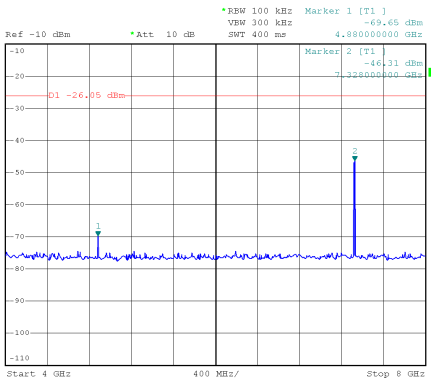
Conducted measure (channel 18)

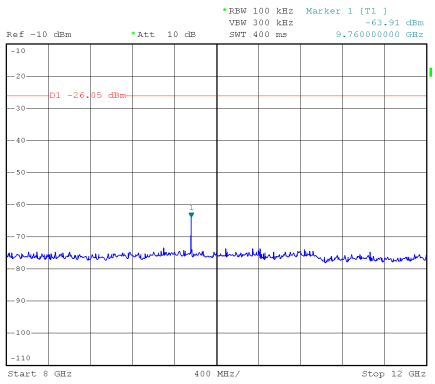


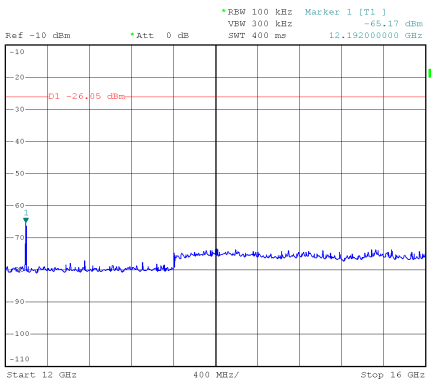


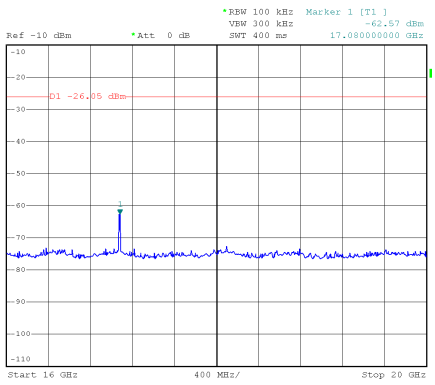


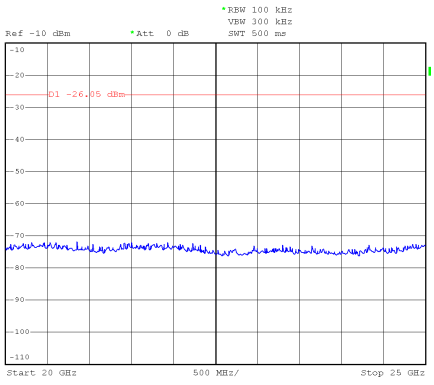



RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-69.65 dBm
4.980000000 GHz
Marker 2 [T1]
-46.31 dBm
7.328000000 GHz
Ref -10 dBm
Att 10 dB
D1 -26.05 dBm
Start 4 GHz
400 MHz/
Stop 8 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-63.91 dBm
9.760000000 GHz
Ref -10 dBm
Att 10 dB
D1 -26.05 dBm
Start 8 GHz
400 MHz/
Stop 12 GHz

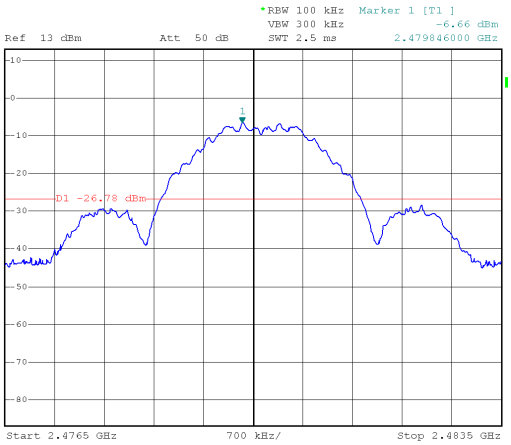

RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-65.17 dBm
12.192000000 GHz
Ref -10 dBm
Att 0 dB
D1 -26.05 dBm
Start 12 GHz
400 MHz/
Stop 16 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-62.57 dBm
17.080000000 GHz
Ref -10 dBm
Att 0 dB
D1 -26.05 dBm
Start 16 GHz
400 MHz/
Stop 20 GHz

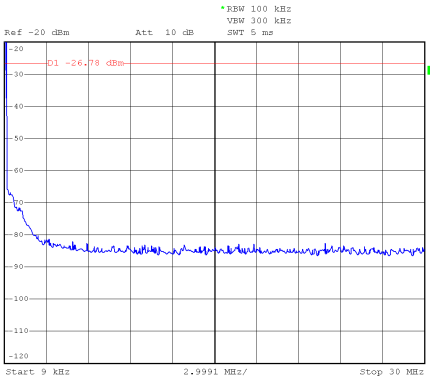

RBW 100 kHz
VBW 300 kHz
SWT 500 ms
Ref -10 dBm
Att 0 dB
D1 -26.05 dBm
Start 20 GHz
500 MHz/
Stop 25 GHz

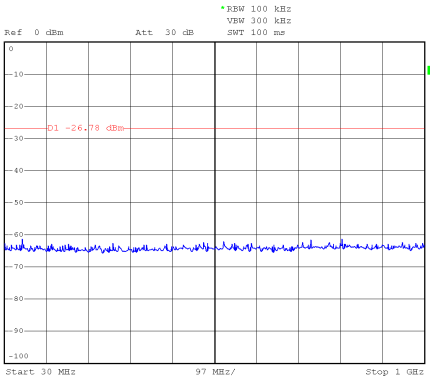
PEAK RESULT Channel n°18: 2,440.00 MHz				
Frequency (MHz)	**Measured Level (dBm)**	**Limit (dBm) Fundamental value – 20dB**	**Limit (dBm) Restricted band - 33dBm**	**Margin (dB)**
2,440 (fundamental)	-6.05	---	---	---
4,880	-69.65	---	-33	-36.65
7,328	-46.31	---	-33	-13.31
9,760	-63.91	-26.05	---	-37.86
12,192	-55.17	---	-33	-22.17
17,080	-62.57	-26.05	---	-36.52

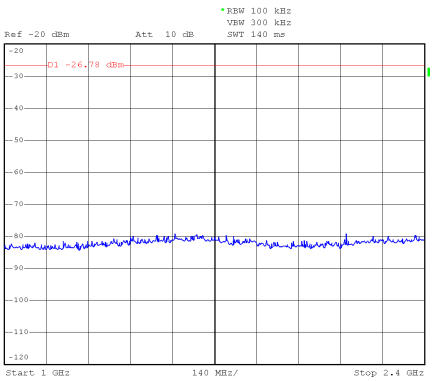
Channel 26 : Power for determination limit line

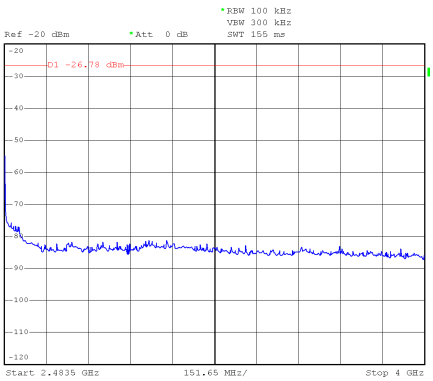


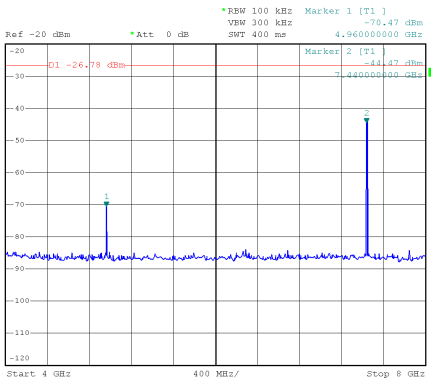
Conducted measure (channel 26)

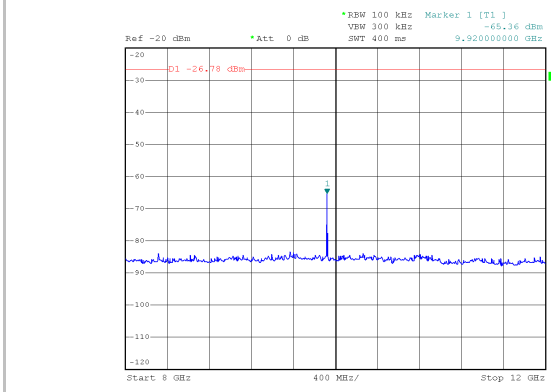


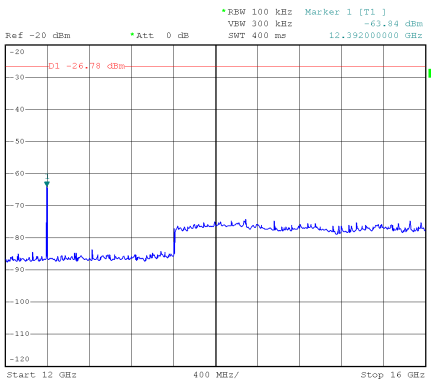


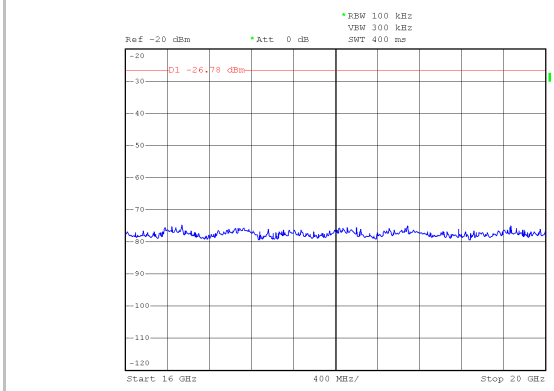


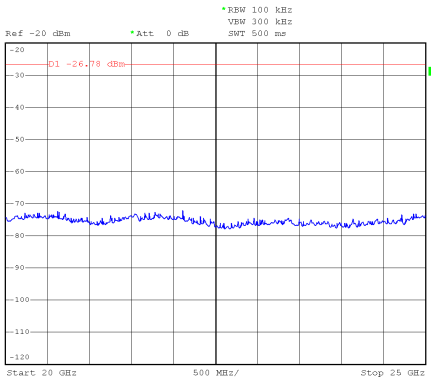



RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-70.47 dBm
4.960000000 GHz
Marker 2 [T1]
-44.47 dBm
7.440000000 GHz
Ref -20 dBm
Att 0 dB
D1 -26.78 dBm
Start 4 GHz
400 MHz/
Stop 8 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-65.36 dBm
9.920000000 GHz
Ref -20 dBm
Att 0 dB
D1 -26.78 dBm
Start 8 GHz
400 MHz/
Stop 12 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-63.84 dBm
12.392000000 GHz
Ref -20 dBm
Att 0 dB
D1 -26.78 dBm
Start 12 GHz
400 MHz/
Stop 16 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Ref -20 dBm
Att 0 dB
D1 -26.78 dBm
Start 16 GHz
400 MHz/
Stop 20 GHz


RBW 100 kHz
VBW 300 kHz
SWT 500 ms
Ref -20 dBm
Att 0 dB
D1 -26.78 dBm
Start 20 GHz
500 MHz/
Stop 25 GHz

PEAK RESULT Channel n°26: 2,480.00 MHz				
Frequency (MHz)	**Measured Level (dBm)**	**Limit (dBm) Fundamental value – 20dB**	**Limit (dBm) Restricted band - 33dBm**	**Margin (dB)**
2,480 (fundamental)	-6.66	---	---	---
4,960	-70.47	---	-33	-37.47
7,440	-44.47	---	-33	-11.47
9,920	-65.36	-26.66		-38.70
12,392	-63.84	---	-33	-30.84

7.7 TRANSMITTER POWER SPECTRAL DENSITY

TEST REQUIREMENT	
Spectrum analyzer settings	
Span	1.5 MHz
Resolution bandwidth (RBW)	3 kHz
Video bandwidth (VBW)	10 kHz
Sweep time (SWT)	500 s
Detector function	Peak
Trace	Max hold
Attenuator	/
Deviation to test procedure	None
EUT operating condition	#1
Remark	None

TEST RESULT
The EUT meets the requirements of sections 15.247 (e)

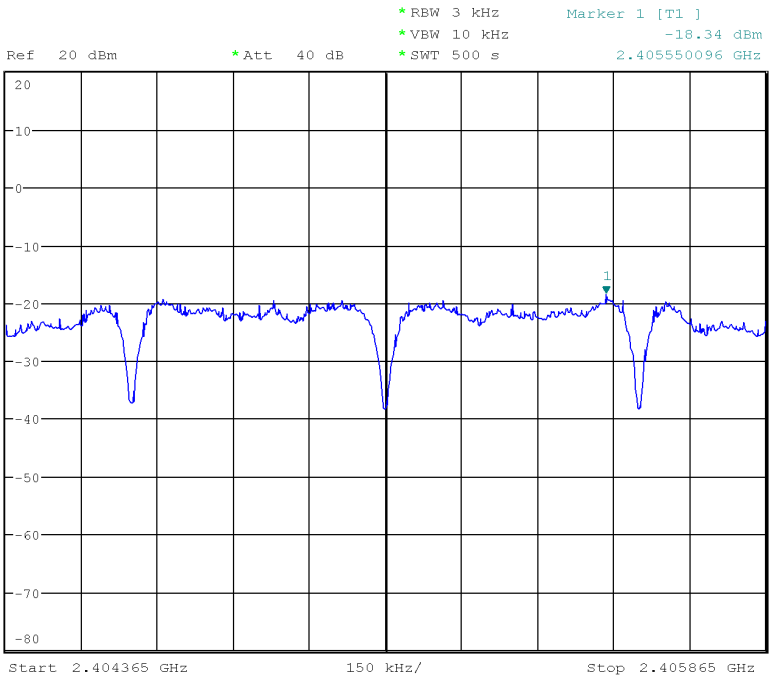
LIMITS
8 dBm

TEST PROCEDURE
The transmitter output was connected to the spectrum analyzer through a temporary RF 50Ω connector. After trace stabilisation the marker shall be set on the signal peak. The indicated level is the power spectral density.

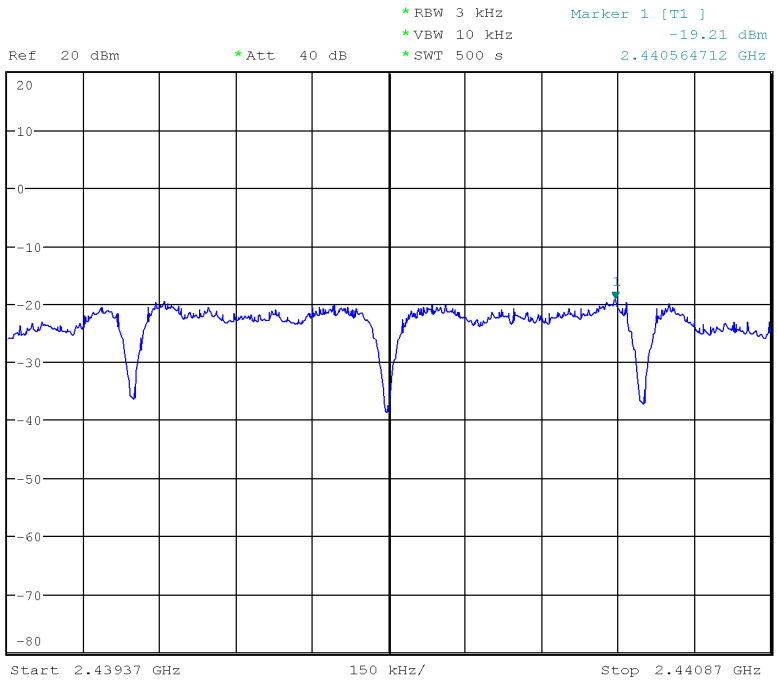
MEASUREMENTS RESULTS

Channel (No.)	Frequency (MHz)	Transmitter power on 3 kHz band (dBm)	Plot (No.)
11	2,405	-18.34	1
18	2,440	-19.21	2
26	2,480	-19.02	3

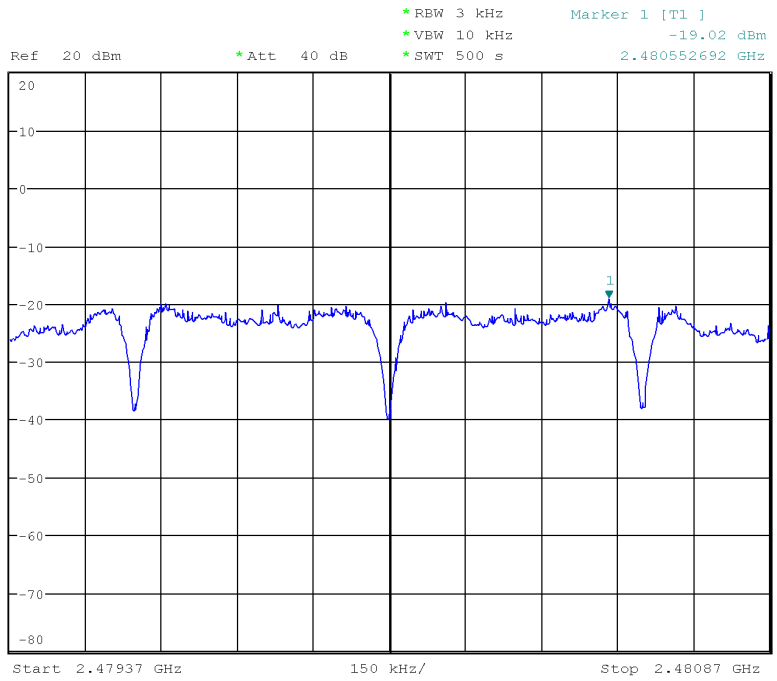
Plot 1



Plot 2


*RBW 3 kHz
*VBW 10 kHz
*SWT 500 s
Marker 1 [T1]
-19.21 dBm
2.440564712 GHz
Ref 20 dBm
*Att 40 dB
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.43937 GHz
150 kHz/
Stop 2.44087 GHz

Plot 3


*RBW 3 kHz
*VBW 10 kHz
*SWT 500 s
Marker 1 [T1]
-19.02 dBm
2.480552692 GHz
Ref 20 dBm
*Att 40 dB
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.47937 GHz
150 kHz/
Stop 2.48087 GHz

7.8 RF EXPOSURE EVALUATION

TEST REQUIREMENT	
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 § 1.1307(b)(1).	
EUT classification (fixed, mobile or portable devices)	Portable according to § 2.1093(b) of this Chapter
LIMITS	According to § 2.1093 of this Chapter, by means of the following guidelines: OET Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies (447498 D01 General RF Exposure Guidance v05r01)

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

447498 D01 General RF Exposure Guidance v05r01 – Appendix A

MHz	**5**	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	**10**	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

The *test separation distances* ≥ 5 *mm* is applied to determine SAR test exclusion.

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

447498 D01 General RF Exposure Guidance v05r01 § 4.3

Channel No.	Frequency (MHz)	Radiated power (dBm)	Radiated power (mW)	Distance (mm)	$\frac{max.\ power\ (mW)}{min.\ distance\ (mm)} \cdot \sqrt{f(GHz)}$	Limits
11	2,405	-6.55	0.22	5	0.0682	≤ 3.0 for 1-g head SAR or ≤ 7.5 for 10-g extremity SAR
18	2,440	-6.91	0.20	5	0.0625	
26	2,480	-7.59	0.17	5	0.0535	

TEST RESULT

This value is less than the low threshold limit. No SAR test is required..

8. MEASUREMENTS AND TESTS UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the IMQ procedure No. IO-DT-U01 and requirement of NIST Technical Note 1297 and NIS 81: 1994 “The Treatment of Uncertainty in EMC Measurements”

Methods	Expanded Uncertainty	Unit	confidence level	Coverage factor	Degree of freedom
Radiated emission (30 ÷ 1000 MHz)	4.77	dB	95 %	2	9
Radiated emission (above 1000 MHz)	3.53	dB	95 %	2	9

9. LIST OF MEASURING EQUIPMENT AND CALIBRATION INFORMATION

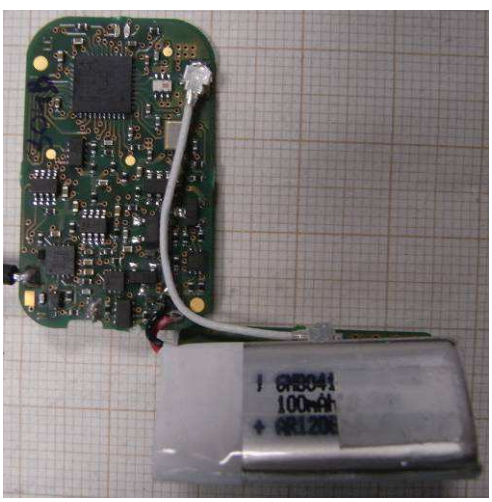
IMQ Serial Number	Instrument	Manufacturer	Type	Last Cal.	Cal. Period.	Calibration Company
P01709	Shielded semi-anechoic chamber	SIDT	/	07-12	12	IMQ
P02486	Turntable controller unit	FRANKONIA	FCTAM01	/	/	/
P02488	Mast antenna	FRANKONIA	FAM4	/	/	/
S05562	EMI Receiver	ROHDE & SCHWARZ	ESU 8	08-12	12	INRIM
S02350	EMI Receiver	ROHDE & SCHWARZ	ESMI-RF	06-12	12	INRIM
S03511	Log antenna	ARA	LPB-2520/1	04-12	36	NPL
S04271	Log antenna	ARA	LPB-2513/A	11-11	36	NPL
S03463	Horn Antenna	SCHWARZBECK	BBHA 9120D	09-11	36	NPL
S04272	Horn antenna	SCHWARZBECK	BBHA 9120D	07-11	36	NPL
S03629	Spectrum Analyzer	Rohde & Schwarz	FSP40	10-12	12	I.N.RI.M.
S03542	Preamplifier	Hewlett Packard	HP 8449B	02-11	24	IMQ
S04193	Preamplifier	Bonn Elektronik	BLNA 0110-15C35	03-12	12	IMQ
S-05039	EMI cable	/	EMI1	09-11	12	IMQ
S-05041	Micro-coax cable	Rosenberger micro	UFB311A	02-12	12	IMQ
S04159	Multimeter	Fluke	45	02-12	12	IMQ
W-00199/E	Software	ROHDE & SCHWARZ	EMC32 Ver. 6.30	/	/	/
H-00165	PC	/	/	/	/	/

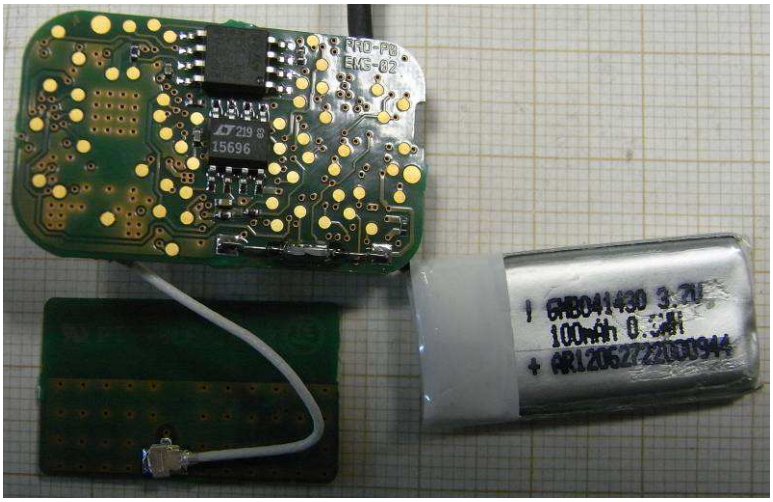
Note: The IMQ instruments are tested and calibrated according to UNI EN 45001, the IMQ procedure IP-037 "Calibration test equipment and measurement" and according to plans set on IMQ operating instruction IO-FT-034 “Criteria for the calibration of test equipment and measurement” which are an integral part of the Quality Manual of IMQ.

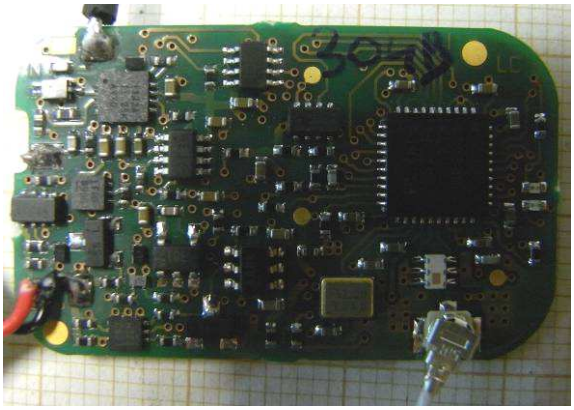
10. PHOTOGRAPHIC DOCUMENTATION

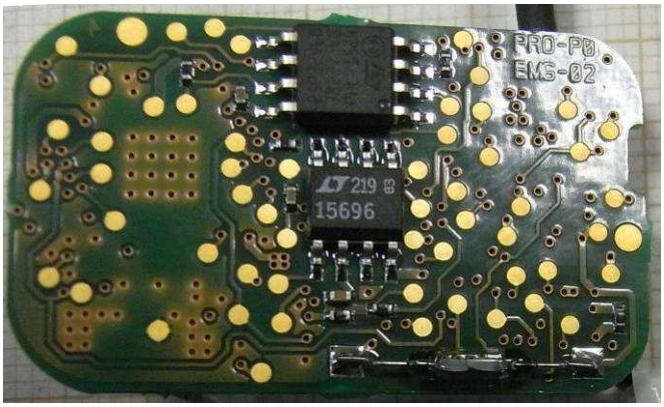
EUT IDENTIFICATION

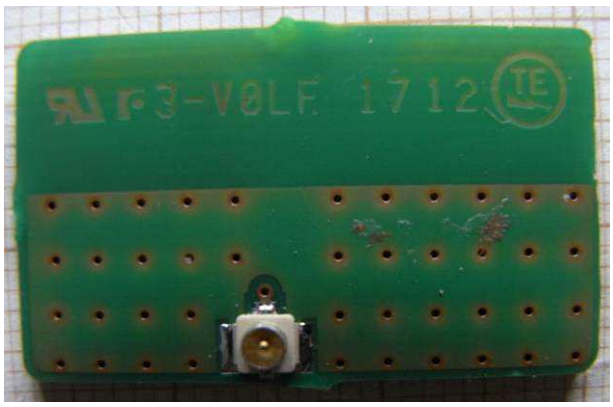
EUT IDENTIFICATION

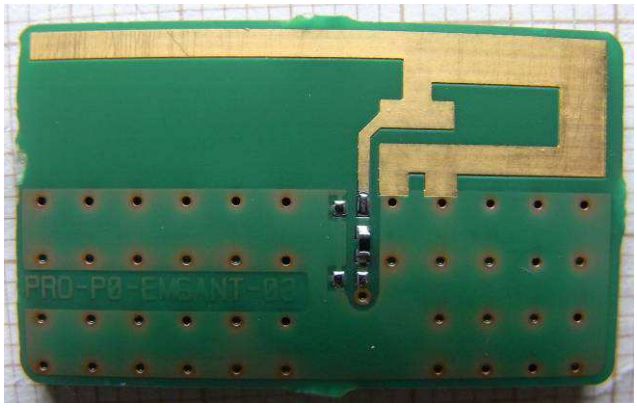






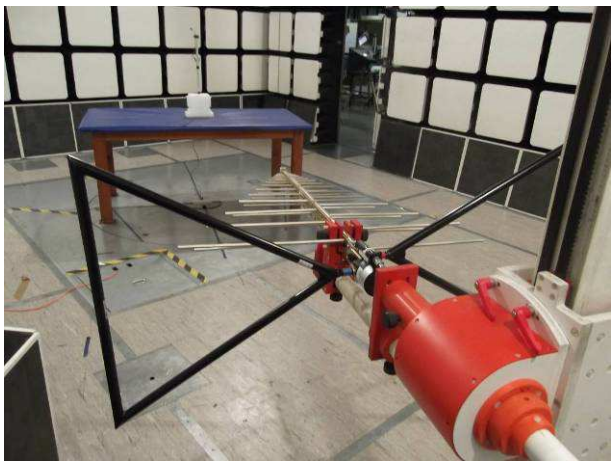






SET-UP

Test set-up radiated emission test



END OF TEST REPORT