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EMITECH MONTPELLIER laboratory
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RADIO TEST REPORT

FCC part 15.247
RSS-247_Issue 2, February 2017

Company: **TRAXENS SA**
Address.....: 16 RUE LOUIS LEPRINCE RINGUET HELIOPOLIS 3
MARSEILLE 13013
FRANCE

Test item description: **BLE module (included in TRAXENS BOX0022)**
Trade Mark: TRAXENS
Manufacturer: TRAXENS SA
Model/Type reference.....: 2PW-042-002 / BOX0022
FCC ID.....: 2AHZ6TRBV2
IC: 25616-TRBV2
Ratings.....: 12Vdc to 24Vdc / 12Vac to 24Vac 50Hz-60Hz

Testing Laboratory: **EMITECH MONTPELLIER laboratory**
Address.....: 145 rue de Massacan
34740 VENDARGUES
FRANCE

Report Reference No.: **R412-19-103221-8A**
Test procedure: FCC IC Certification
Diffusion.....: Mr FARADI
Applicant's name: TRAXENS SA
Date of issue.....: March 25, 2020
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Compiled by.....: Olivier AELBRECHT
Approved by (+ signature).....: David MONTAULON (Technical Manager)

*Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of
the whole manufactured products of the tested sample.*



Siège Social : Emitech - 3, rue des Coudriers - Z.A. de l'Observatoire - 78180 MONTIGNY LE BX - France
Siret : 344 545 645 00022 - Tél. : 33 (0)1 30 57 55 55 - Fax : 33 (0)1 30 43 74 48 - E-mail : contact@emitech.fr - URL : www.emitech.fr
SAS au capital de 1 560 000 € - R.C.S. VERSAILLES 344 545 645 - APE 7112B



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REVISION HISTORY:

Revision	Date	Modified pages	Modifications
0	March 25, 2020	/	Creation

This document submits the results of Radio tests performed on the equipment **BLE module (included in TRAXENS BOX0022)** (denominated hereafter E.U.T.: equipment under test) according to document(s) listed in §2 of this test report.

2. REFERENCE DOCUMENT(S)

NORMATIVE REFERENCES:

The following referenced documents are necessary for the application of the present test report.

FCC part 15

Code of federal regulations. Title 47- Telecommunication Chapter 1- Federal Communication Commission. Part 15- Radio frequency devices Subpart B- Unintentional Radiators. Limits and methods of measurement of radio disturbance. Characteristic of information technology equipment

FCC part 15.247

Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz. (frequency hopping and digitally modulated)

RSS-247_Issue 2, February 2017

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence Exempt Local Area Network (LE-LAN) Devices

ANSI C 63.10:2013

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI C 63.4:2014

American National Standard for Methods of measurement of Radio-Noise from low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Although the product standard uses obsolete technical standards, the latest versions of standards achievable by the laboratory will be used for testing.

INFORMATIVE REFERENCES:

The following referenced documents are not necessary for the application of the present test report but they assist the user with regard to a particular subject area.

3. EQUIPMENT TECHNICAL DESCRIPTION

3.1. Test Conditions

Test item description.: BLE module (included in TRAXENS BOX0022)
Model/Type reference.....: 2PW-042-002 / BOX0022
Trade Mark.: TRAXENS
FCC ID.....: 2AHZ6TRBV2
IC.: 25616-TRBV2
Serial number (S/N).....: 0020201929000003 (TRAXENS BOX0022)
Part number (P/N).: Not communicated (TRAXENS BOX0022)
Software version.....: V1.6 (TRAXENS BOX0022)
Firmware version.: Not communicated (TRAXENS BOX0022)
Type of sample.: Pre-serial
Function(s).....: Smart container tracker
Manufacturer name.: TRAXENS SA
Address.....: 16 RUE LOUIS LEPRINCE RINGUET HELIOPOLIS 3
MARSEILLE 13013
FRANCE

General product information:

N/A

3.2. EUT Marking plate



MODEL : 2PW-042-002
BOX0022

IMEI: 358674528976410
MAC @ BLE: 50:DE:19:30:00:7A
FCC ID: 2AHZ6TRBV2
IC: 25616-TRBV2

CONTAINS:
FCC ID: 2AHZ6WING4TRAX
IC: 25616-W4T
FCC ID: QIPPLS62-W
IC: 7830A-PLS62W

SN: 20204D0001929000001



HELIOPOLIS III
16 rue Louis Leprince Ringuet
13013 Marseille - FRANCE



IP68



CRC: 02

3.3. EUT General view (TRAXENS BOX0022)



3.4. EUT electronic board and BLE module part

BLE module part is identified inside black square



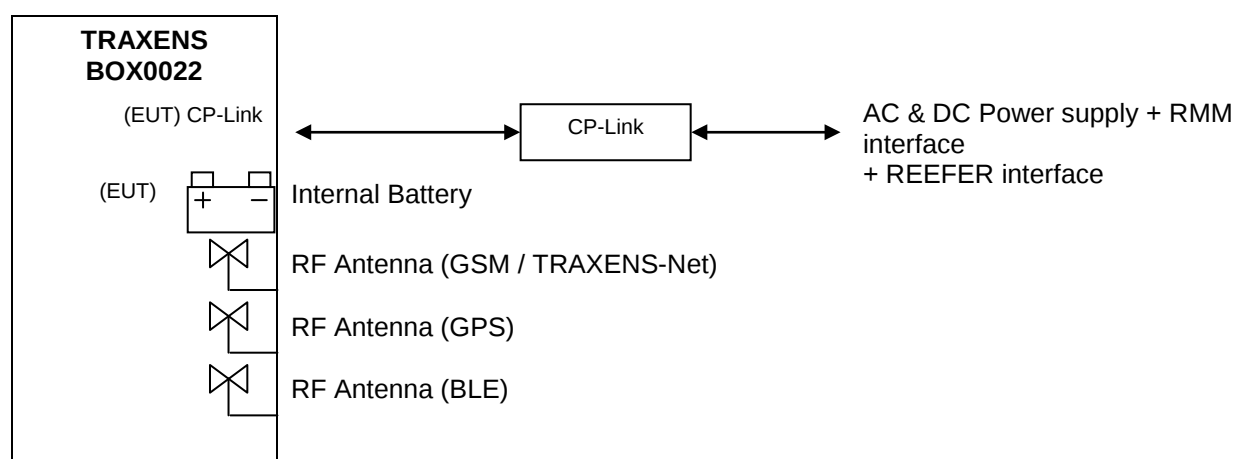
3.5. EUT Mechanical and Electrical Design

Power supply..... : 24Vdc
 Power supply range..... : 12Vdc to 24Vdc / 12Vac to 24Vac 50Hz-60Hz
 Power type..... : AC & DC
 Power (W)..... : 3.6
 Nominal current (A). : Not communicated
 Dimensions (L x W x H) (m). : 220x92x60mm
 Weight (kg). : 0.430
 Temperature range (°C). : 85°C to -40°C
 Ground bounding strap..... : No

Comments:

N/A

3.6. EUT Input/Output ports



PORT	NAME	TYPE	LENGHT	CABLE TYPE	COMMENTS
0	Main frame	N/E	N/A	Plastic	N/A
1	AC & DC Power supply + RMM interface + REEFER interface	AC/DC /IO	40cm	Not shielded	Input Voltage supply = 12Vdc to 24Vdc
2	Internal Battery	DC	N/A	N/A	7.2Vdc
3	RF Antenna	RF	N/A	N/A	GSM / TRAXENS-NET
4	RF Antenna	RF	N/A	N/A	Bleutooth
5	RF Antenna	RF	N/A	N/A	GPS

AC/DC : AC/DC Converter port AC: Alternative current port DC : Discontinuous current port
 I/O.....: Input or Output port TP.....: Telecommunication port RF..... : Radio frequency port
 N/E: Non Electrical port

3.7. Supporting Equipment Used During Test

Sample subject to the tests was tested with following equipment.

PRODUCT TYPE	MANUFACTURER	MODEL	N°EMITECH / COMMENTS
Test Platorm	TRAXENS	ABALON V5 TEST PLATFORM	Used for conducted measurement

TEST PLATRORM (EA)



3.8. EUT Radio Specifications

a) GENERAL INFORMATIONS	
According to manufacturer's declarations :	
EUT type.....	: SRD
Technology	: TRAXSENS-Net / GPS / GPRS - GSM / BLE
Environmental profile.....	: Data transmissions
Temperature range.....	: 85° to -40°C
Antenna type	: Internal
Antenna Gain.....	: Not communicated (integral)
Comments: EUT includes RF modules (GSM, GPRS, UMTS, LTE and TRAXENS-NET) which are already certified. BLE technology was considered as a DTS technology.	
a) TRANSMITTER PARAMITERS (Tx)	
Frequency bands.....	: TRAXENS-Net: 902MHz to 928 MHz BLE: 2400MHz to 2483.5MHz GPRS-2G: GSM850: 824.2 MHz to 848.8 MHz GSM900: 880 MHz to 915 MHz GSM1800: 1710.2 MHz to 1784.8 MHz GSM1900: 1850.2 MHz to 1909.8 MHz UMTS-3G: Band 1: 1920 MHz to 1980 MHz Band 4: 1710 MHz to 1755 MHz LTE-4G: Band 1: 1920 MHz to 1980 MHz Band 2: 1850 MHz to 1910 MHz Band 4: 1710 MHz to 1755 MHz Band 7: 2500 MHz to 2570 MHz Band 12: 699 MHz to 716 MHz
RF Power.....	: BLE: <10dBm
Number of channels / Separation.....	: BLE: 40 channels each 2MHz
Modulation type	: DSSS
Duty cycle	: N/A
Tested frequency.....	: BLE: 2402MHz (Low channel) 2440MHz (Mid Channel) 2480MHz (High channel)
b) RECEIVER PARAMETERS (Rx)	
Frequency bands.....	: TRAXENS-Net: 902MHz to 928 MHz BLE: 2400MHz to 2483.5 MHz GPRS-2G: GSM850: 869.2 MHz to 893.8 MHz GSM900: 925 MHz to 960 MHz GSM1800: 1805.2 MHz to 1879.8 MHz GSM1900: 1930.2 MHz to 1989.8 MHz UMTS-3G: Band 1: 2110 MHz to 2170 MHz Band 4: 2110 MHz to 2155 MHz LTE-4G: Band 1: 2110 MHz to 2170 MHz Band 2: 1930 MHz to 1990 MHz Band 4: 2110 MHz to 2155 MHz Band 7: 2620 MHz to 2690 MHz Band 12: 729 MHz to 746 MHz GPS: 1559MHz to 1610MHz
Bandwidth	: Not communicated

4. OPINION(S) AND INTERPRETATION(S)

TEST(S) PERFORMED	DEVIATION(S) TO TEST METHOD(S)
FCC part 15.247 and RSS-247	N/A
FCC part 15.109, 15.209, 15.205, 15.215 RSS-247, CNR Gen	N/A

Comments: N/A

5. RESULT SUMMARY

TEST DESIGNATION	SEVERITY	VERDICT	BASIC STANDARDS / COMMENTS
General			
- Labeling requirements	-	PASS	15.19
- Information to user	-	PASS	15.21
- Measurement standards	-	PASS	15.31
- Frequency range of radiated measurements	-	PASS	15.33
- Measurement detector functions and bandwidths	-	PASS	15.35
- Transition provisions for compliance with the rules	-	PASS	15.37
- Conducted power limits	B	PASS	15.107/207
Operation within the band 902-928MHz, 2400-2483.5MHz and 5725-5850MHz			15.247
- Frequency hopping and digitally modulated		-	a)
- Frequency hopping system		N/A	a) (1)
- Digital modulation system		PASS	a) (2)
- Maximum peak conducted output power		-	b)
- For hopping system in the 2400-2483.5 MHz and 5725-5850 MHz bands		N/A	b) (1)
- For hopping system in the 902-928MHz band		N/A	b) (2)
- For system using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands		PASS	b) (3) / EUT has its dedicated internal PCB antenna, due to this, this measurement was done in radiated.
- Operation with directional antenna gains > 6 dBi		N/A	c)
- Out-of-band emissions		PASS	d)
- Power spectral density conducted		PASS	e)
- Hybrid system		N/A	f)
- Frequency hopping additional requirements		N/A	g)
- Frequency hopping intelligence		N/A	h)
- RF exposure compliance		PASS	i)

Sample subject to the test complies for tests done with the requirements of the reference document(s) listed in §2 of this test report and, where applicable, with deviation(s) specified in this document.

To declare, or not, the compliance with the specifications, it was not explicitly taken account of uncertainty associated with the results.

TEST(S) PERFORMED	MODIFICATION(S)
FCC part 15.247 and RSS-247	N/A
FCC part 15.109, 15.209, 15.205, 15.215 RSS-247, CNR Gen	N/A

6. RF EXPOSURE

Maximum EIRP with = 7.031. mW (eirp) at 2440MHz

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

PSD= $EIRP / (4 \cdot \pi \cdot R^2) = 7.031 / (4 \cdot \pi \cdot (20 \text{ cm})^2) = 0.001 \text{ mW/cm}^2$

Limit= 1 mW/cm²

7. MEASUREMENT UNCERTAINTY

PARAMETER	MAXIMAL EMITECH UNCERTAINTY	MINIMAL STANDARD UNCERTAINTY
Radio frequency	$\pm 1 \times 10^{-7}$	$\pm 1 \times 10^{-7}$
RF power, conducted		
RF power	$\pm 0.8 \text{ dB}$	$\pm 1 \text{ dB}$
Power spectral density	$\pm 2.3 \text{ dB}$	$\pm 3 \text{ dB}$
Occupied bandwidth		
RF power	$\pm 3.8 \%$	$\pm 5 \%$
Adjacent channel power	$\pm 1.6 \text{ dB}$	$\pm 3 \text{ dB}$
Sensibility of receiver (conducted)	$\pm 2.0 \text{ dB}$	$\pm 3 \text{ dB}$
Conducted emission (spurious)		
$f \leq 1 \text{ GHz}$	$\pm 0.8 \text{ dB}$	
1 GHz - 12.75 GHz	$\pm 1.6 \text{ dB}$	$\pm 3 \text{ dB}$
Radiated emission (PAR / PIRE / RNE)		
$f \leq 62.5 \text{ MHz}$	$\pm 5.1 \text{ dB}$	$\pm 6 \text{ dB}$
62.5 MHz - 1 GHz	$\pm 5.1 \text{ dB}$	$\pm 6 \text{ dB}$
1 GHz - 18 GHz	$\pm 5.2 \text{ dB}$	$\pm 6 \text{ dB}$
18 GHz – 26 GHz	$\pm 5.1 \text{ dB}$	$\pm 6 \text{ dB}$
26 GHz – 40 GHz	$\pm 5.4 \text{ dB}$	$\pm 6 \text{ dB}$
PIRE and power spectral density with diode	$\pm 5.4 \text{ dB}$	$\pm 6 \text{ dB}$
Radiated emission (magnetic field)		
9kHz – 30MHz	$\pm 3 \text{ dB}$	$\pm 6 \text{ dB}$
RF level for a given BER	$\pm 0.8 \text{ dB}$	$\pm 1.5 \text{ dB}$
Supply voltages	$\pm 3 \%$	$\pm 3 \%$
Temperature	$\pm 1 \text{ }^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5 \%$	$\pm 5 \%$
Time / Duty cycle	$\pm 4.4 \%$	$\pm 5 \%$
Adaptivity	$\pm 2.9 \text{ dB}$	/
Radiated emission (electric field for FCC standard)		
9kHz – 30MHz	$\pm 2.7 \text{ dB}$	/
30MHz – 1GHz	$\pm 5.0 \text{ dB}$	/
1GHz – 18GHz	$\pm 5.6 \text{ dB}$	/
18GHz – 26GHz	$\pm 5.7 \text{ dB}$	/
26GHz – 40GHz	$\pm 5.7 \text{ dB}$	/

For the calcul of expanded uncertainty, the confidence interval is 95 % (k=2).

8. TEST CONDITIONS AND RESULTS

8.1. Conducted emission (measurement)

Reference standard:	FCC part 15 and RSS-Gen
Test method:	ANSI C63.10: 2013
General test setup: EUT is set on an insulating support at 80cm above the ground reference plane. All power was connected to the system through Artificial Mains Network (AMN). The AMN is placed at 80cm from the boundary of the EUT and bonded to a ground reference plane. Additional ground terminals (if any) are connected to earth terminal of the AMN.	

TESTED CABLE	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
110Vac/60Hz Power supply	150kHz-30MHz	Class B	EMI5205	PASS

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	See Graph(es)
Relative Humidity	30 to 60 %	See Graph(es)
Atmospheric pressure	N/A	See Graph(es)
Test method deviation: N/A		
Supplementary information: EUT is supplied by a "standard" power supply (Mean-Well, EDR-150-24).		

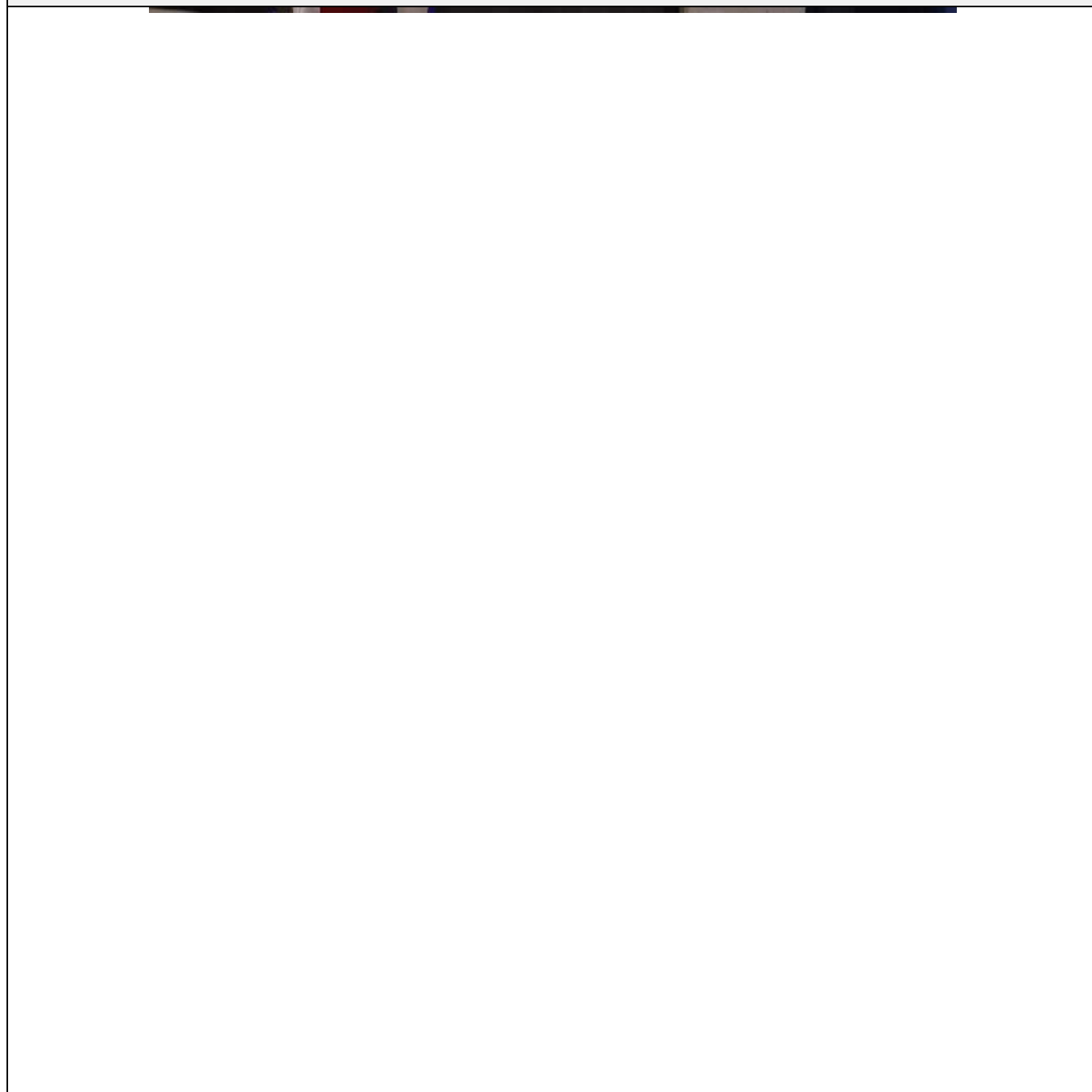
TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Cable	EMITECH	Current absorber sheath	9491	12/02/2018	12/04/2020
Cable	SUCOFLEX	N-6,5m	14380	25/07/2019	25/09/2021
Cable	MegaPhase	N-8m	15813	12/11/2018	12/01/2021
Cable	MegaPhase	TM18-N1N1-118	12841	09/05/2018	09/07/2020
LISN	AFJ	LT32C\10	12007	10/01/2019	10/03/2020
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
PE choke	EMITECH	CISPR 16-2-1 : 2008	10071		
PE choke	EMITECH	CISPR 16-2-1 : 2008	10081		
Receiver	Agilent Technologies	E7405A	2161	11/10/2018	11/12/2020
Receiver	Rohde & Schwarz	ESHS10	3371(*)	25/09/2018	25/05/2020
Shielded enclosure	COMTEST	SAC 3m	14494		
Software	Nexio		0000		
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021

BAT-EMC software version: V3.18.0.26

Blank cells = Permanent validity

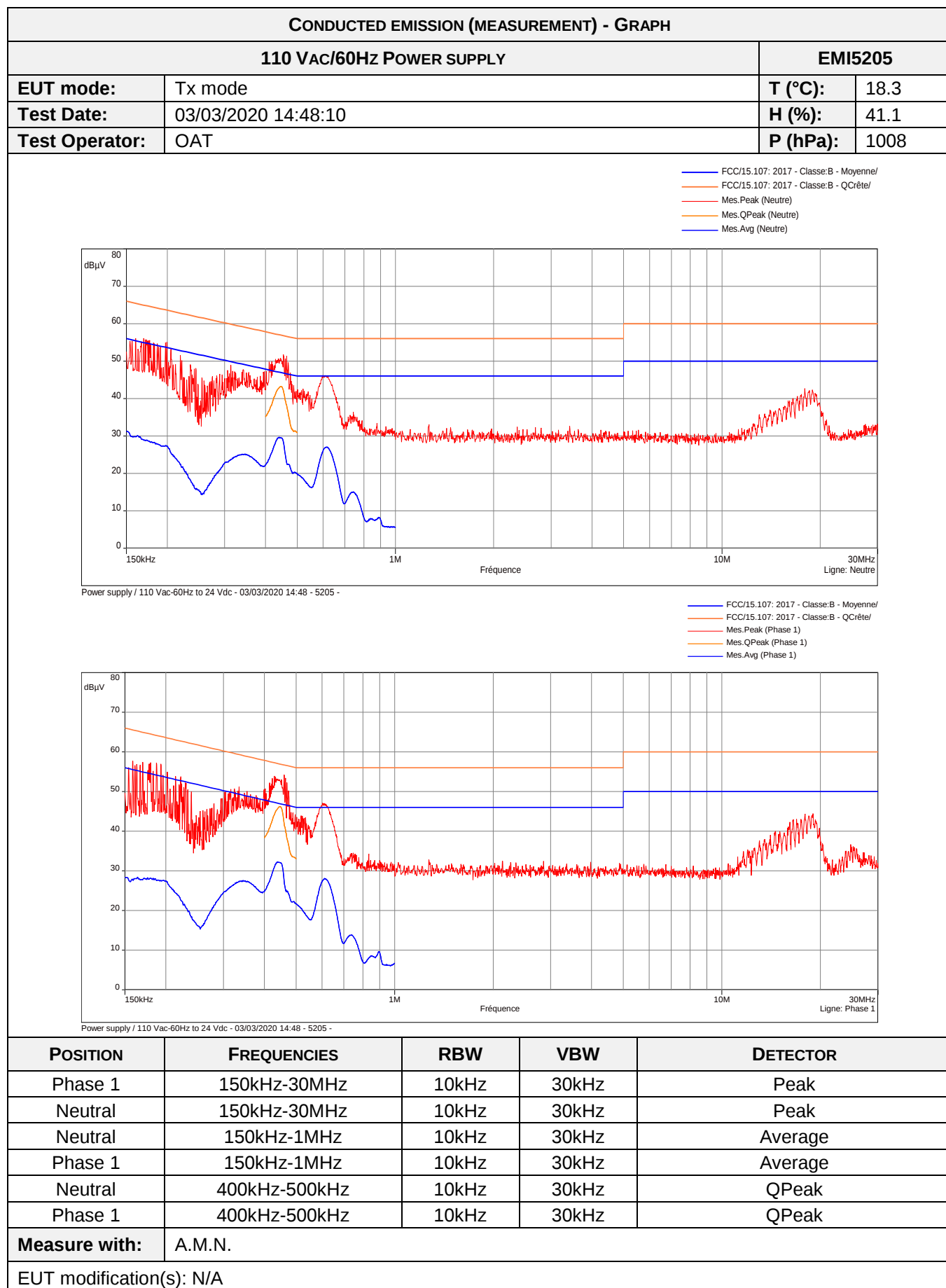
(*) Under derogation EQS DER 000 S41 00069

TEST SETUP PHOTO(S) - 110 VAC/60Hz POWER SUPPLY



CONDUCTED EMISSION (MEASUREMENT) - TABULATED RESULTS

110 VAC/60Hz POWER SUPPLY						EMI5205	
Terminal	Test Frequency (MHz)	Meter Reading dB (μV)	Detector (Pk/QP/Av)	Gain/Loss Factor (dB)	Level dB (μV)	Limit dB (μV)	Margin (dB)
Neutral	0.445	/	Pk	/	50.42	56.968	6.548
Neutral	0.445	/	QP	/	43.181	56.968	13.787
Neutral	0.445	/	Av	/	29.501	46.968	17.467
Supplementary information: N/A							



8.2. Transmitter radiated spurious emissions at frequencies <30MHz

Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	ANSI C63.10: 2013
Test description: : Spurious domain emission limits are limits on emissions at frequencies other than those of the carrier and sidebands associated with normal test modulation. EUT is set on an insulating support at 80cm above the ground reference plane. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter in a anechoic chamber. The EUT was rotated 360° in order to maximize radiated levels. Test antenna was oriented in 3 axes (0°, 45° and 90°). Final measurements (quasi-peak) were then performed in a 10-meter Open Area Test Site that complies to CISPR 16 in the same measurement conditions. All frequencies were investigated, where applicable.	

TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
0° - BLE TX MODE	9kHz-30MHz	15.209	EMI4643	PASS
45° - BLE TX MODE	9kHz-30MHz	15.209	EMI4644	PASS
90° - BLE TX MODE	9kHz-30MHz	15.209	EMI4645	PASS

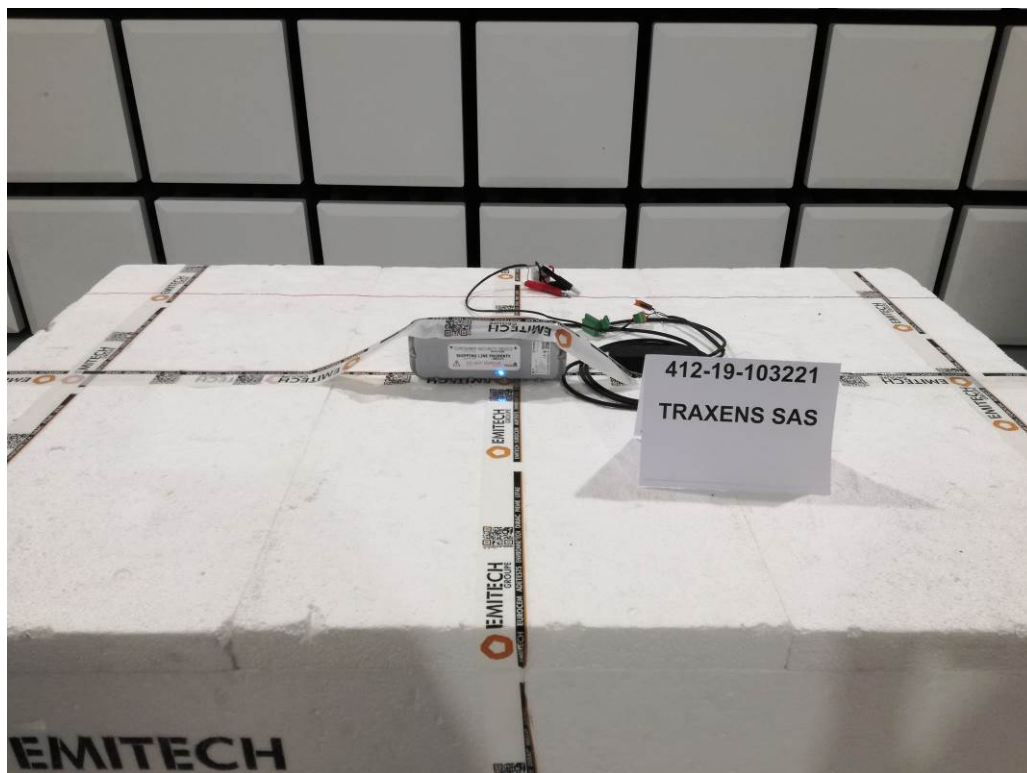
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	See Graph(es)
Relative Humidity	20 to 75 %	See Graph(es)
Atmospheric pressure	N/A	See Graph(es)
Test method deviation: N/A		
Supplementary information: N/A		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	Rohde & Schwarz	HFH2-Z2	5825	20/09/2017	20/11/2019
Cable	MegaPhase	N-3m	14853	12/02/2018	12/04/2020
Cable	SUCOFLEX	N-6,5m	14380	24/07/2019	24/09/2021
Cable	MegaPhase	N-8m	15813	12/11/2018	12/01/2021
Receiver	Agilent Technologies	E4440A	5824	18/04/2018	18/06/2020
Shielded enclosure	COMTEST	SAC 3m	14494	14/02/2017	14/04/2020
Software	Nexio		0000		
Thermohygrometer	Testo	608-H2	12269	27/11/2017	27/01/2020

BAT-EMC software version: V3.18.0.26

Blank cells = Permanent validity

TEST SETUP PHOTO(S) – EUT POSITION

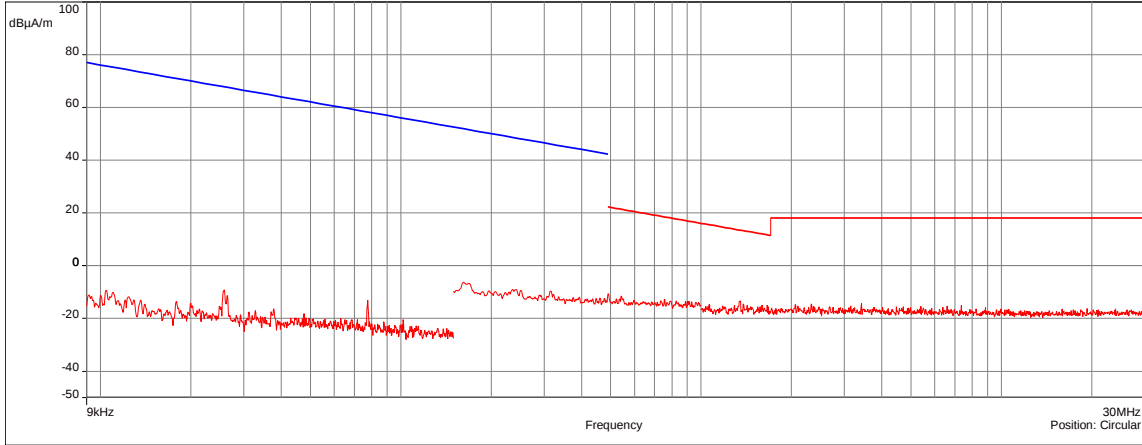


TEST SETUP PHOTO(S)



TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHz - TABULATED RESULTS							
Frequency (MHz)	Polarization	Level Peak (dBμV/m)	Level Avg (dBμV/m)	Limit Qpeak (dBμV/m)	Limit Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin dB
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

No spurious emissions were detected.

TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHZ - GRAPH					
0° - BLE TX MODE			EMI4643		
EUT mode:	CONTINUOUS TX MODULATED		T (°C):	24.1	
Test Date:	25/07/2019 11:12:54		H (%):	54.8	
Test Operator:	OAT		P (hPa):	1005	
FCC/FCC Part 15 §209 Tx - Moyenne/3.0m/ FCC/FCC Part 15 §209 Tx - QCrête/3.0m/ Meas. Peak  9kHz Frequency 30MHz Position: Circular					
POSITION	FREQUENCIES	RBW	VBW	DETECTOR	
Circular	9kHz-150kHz	300Hz	1kHz	Peak	
Circular	150kHz-1MHz	10kHz	30kHz	Peak	
Circular	1MHz-30MHz	10kHz	30kHz	Peak	
Configuration:					
Comments:	Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.				
EUT modification(s): N/A					

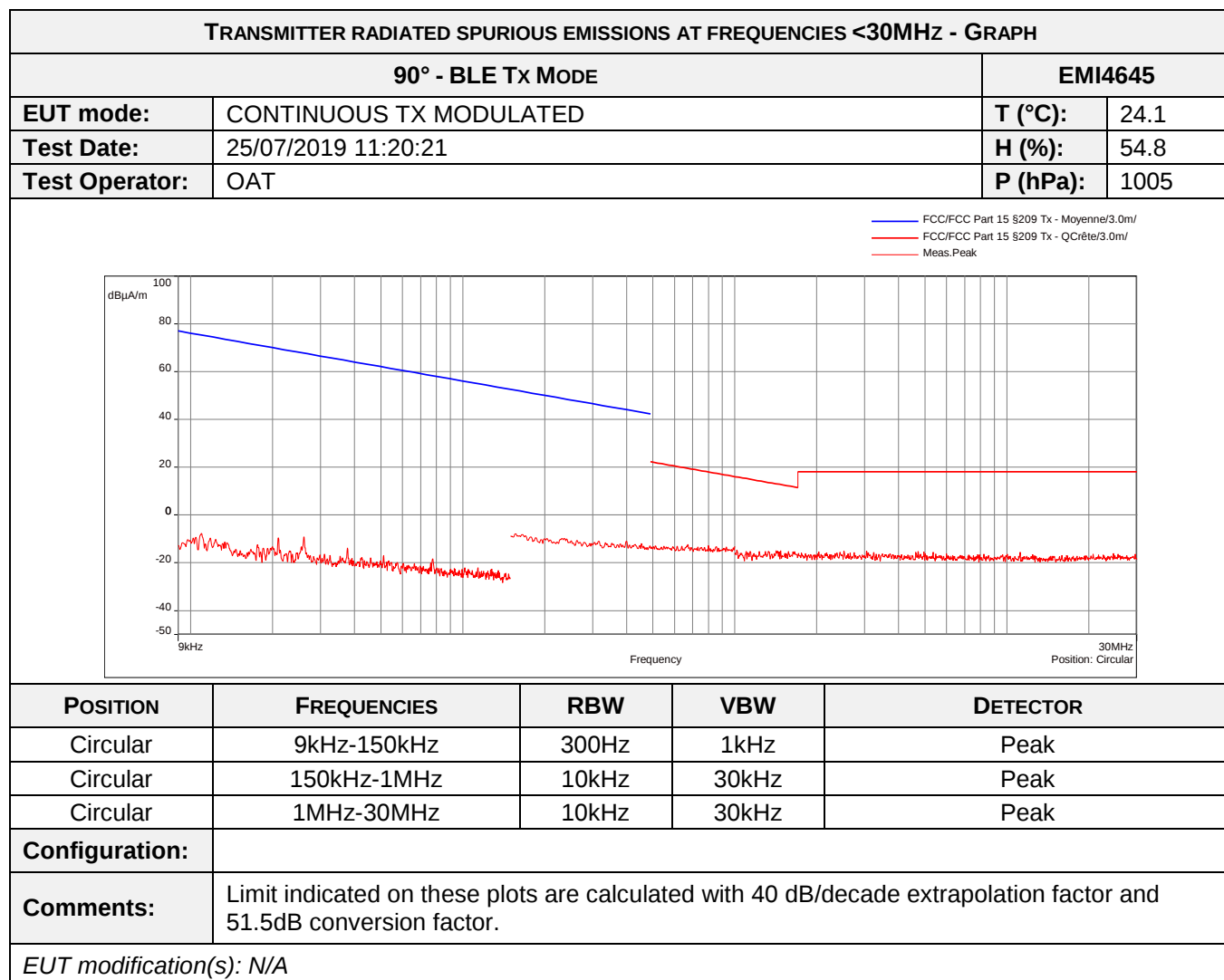
TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHz - TABULATED RESULTS			
0° - BLE TX MODE			EMI4643
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Antenna Position	Level (dBμA/m)	Limit (dBμA/m)
N/A	N/A	N/A	N/A

No spurious emissions were detected.

TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHZ - GRAPH																																															
45° - BLE TX MODE				EMI4644																																											
EUT mode:	CONTINUOUS TX MODULATED			T (°C):	24.1																																										
Test Date:	25/07/2019 11:16:12			H (%):	54.8																																										
Test Operator:	OAT			P (hPa):	1005																																										
FCC/FCC Part 15 §209 Tx - Moyenne/3.0m/ FCC/FCC Part 15 §209 Tx - QCrête/3.0m/ Meas.Peak dBµA/m 100 80 60 40 20 0 -20 -40 -50 9kHz Frequency 30MHz Position: Circular <table><tr><th>POSITION</th><th>FREQUENCIES</th><th>RBW</th><th>VBW</th><th colspan="2">DETECTOR</th></tr><tr><td>Circular</td><td>9kHz-150kHz</td><td>300Hz</td><td>1kHz</td><td colspan="2">Peak</td></tr><tr><td>Circular</td><td>150kHz-1MHz</td><td>10kHz</td><td>30kHz</td><td colspan="2">Peak</td></tr><tr><td>Circular</td><td>1MHz-30MHz</td><td>10kHz</td><td>30kHz</td><td colspan="2">Peak</td></tr><tr><td colspan="2">Configuration:</td><td colspan="4"></td></tr><tr><td colspan="2">Comments:</td><td colspan="4">Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.</td></tr><tr><td colspan="6">EUT modification(s): N/A</td></tr></table>						POSITION	FREQUENCIES	RBW	VBW	DETECTOR		Circular	9kHz-150kHz	300Hz	1kHz	Peak		Circular	150kHz-1MHz	10kHz	30kHz	Peak		Circular	1MHz-30MHz	10kHz	30kHz	Peak		Configuration:						Comments:		Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.				EUT modification(s): N/A					
POSITION	FREQUENCIES	RBW	VBW	DETECTOR																																											
Circular	9kHz-150kHz	300Hz	1kHz	Peak																																											
Circular	150kHz-1MHz	10kHz	30kHz	Peak																																											
Circular	1MHz-30MHz	10kHz	30kHz	Peak																																											
Configuration:																																															
Comments:		Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.																																													
EUT modification(s): N/A																																															

TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHz - TABULATED RESULTS			
45° - BLE TX MODE			EMI4644
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Antenna Position	Level (dBμA/m)	Limit (dBμA/m)
N/A	N/A	N/A	N/A

No spurious emissions were detected.



TRANSMITTER RADIATED SPURIOUS EMISSIONS AT FREQUENCIES <30MHz - TABULATED RESULTS			
90° - BLE Tx Mode			EMI4645
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Antenna Position	Level (dBμA/m)	Limit (dBμA/m)
N/A	N/A	N/A	N/A

No spurious emissions were detected.

8.3. Radiated spurious emissions at frequencies >30MHz

Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	ANSI C63.10: 2013
General test setup: For $f > 30\text{MHz}$, EUT is set on an insulating support at 80cm above the ground reference plane (150cm for $f > 1\text{GHz}$). Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak or average) were then performed in a semi-anechoic chamber or Open Area Test Site that complies to CISPR 16. The EUT was rotated 360° about its azimuth and adjusting the receive antenna height from 1 to 4 m. Above 18GHz measurement were performed at a test distance of 1m. All frequencies were investigated, where applicable. For portable equipments a research of maximum level is done on the 3 axes. Only the highest levels are recorded.	

TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
Tx mode - BLE - All Channels for Freq < 1Ghz	30MHz-1GHz	15.247 & 15.209	EMI4611	PASS
Tx mode - BLE - Low Channel for 1GHz > Freq > 18GHz	1GHz-18GHz		EMI4601	PASS
Tx mode - BLE - Mid Channel for 1GHz > Freq > 18GHz	1GHz-18GHz		EMI4605	PASS
Tx mode - BLE - High Channel for 1GHz > Freq > 18GHz	1GHz-18GHz		EMI4606	PASS
Tx mode - BLE - Low Channel for Freq > 18GHz	18GHz-25GHz		EMI4602	PASS
Tx mode - BLE - Mid Channel for Freq > 18GHz	18GHz-25GHz		EMI4609	PASS
Tx mode - BLE - High Channel for Freq > 18GHz	18GHz-25GHz		EMI4607	PASS

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	See Graph(es)
Relative Humidity	20 to 75 %	See Graph(es)
Atmospheric pressure	N/A	See Graph(es)
Test method deviation: N/A		
Supplementary information: From 30MHz to 1GHz Quasi peak limit provided is the limit given in §15.209. Above 1GHz average limit in restricted bands §15.205 is 54dBµV/m. Otherwise, the limit is 20dB under carrier emission level at 3m without averaging. Above 18GHz test distance is 1m, limits are calculated with an extrapolation factor of 20dB/decade as described in the standard.		

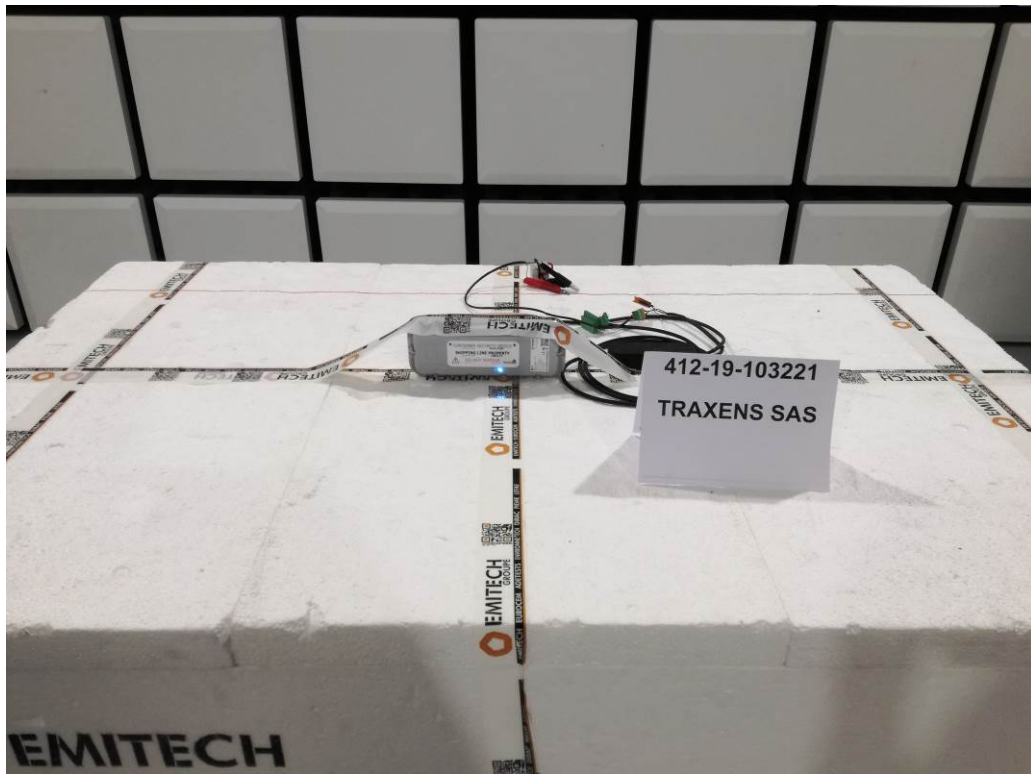
TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	ETS-Lindgren	3117	8387	23/07/2019	23/09/2022

CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	ETS lindgren	3160-09	14691	22/09/2017	22/11/2020
Antenna	Electro Metrics	BIA-30HF	0824	13/06/2018	13/08/2021
Antenna	Rohde & Schwarz	HL223	3126	13/06/2018	13/08/2021
Cable	JYE BAO	K30K30-5003-40G1	14887	25/06/2019	25/08/2021
Cable	Huber + Suhner	K-5m	14459	25/06/2019	25/08/2021
Cable	TechniWAVE	N-0.23m	14895	23/02/2018	23/04/2020
Cable	TechniWAVE	N-0.23m	14898	23/02/2018	23/04/2020
Cable	SUCOFLEX	N-3m	14378	25/06/2019	25/08/2021
Cable	SUCOFLEX	N-3m	14379	25/06/2019	25/08/2021
Cable	MegaPhase	N-3m	14853	12/02/2018	12/04/2020
Cable	SUCOFLEX	N-6,5m	14380	24/07/2019	24/09/2021
Cable	MegaPhase	N-8m	15813	12/11/2018	12/01/2021
Cable	Huber + Suhner	SF102K	16041	28/02/2019	28/04/2021
Cable	MegaPhase	TM18-N1N1-118	12841	09/05/2018	09/07/2020
Cable	MegaPhase	TM18-N1N1-118	12842	09/05/2018	09/07/2020
Cable	MegaPhase	TM18-N1N1-197	12840	09/05/2018	09/07/2020
Filter	Micro-Tronics	HPM 15162	10273	11/01/2019	11/03/2021
Filter	Wainwright Instruments	WRCGV 2402/2480- 2380/2500- 40/10EE-200W	9771	07/01/2019	07/03/2021
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Preamplifier	Techniwave	APS16-0087	14040	25/06/2019	25/08/2020
Preamplifier	Wright Technologie	ASL40-B3015	14851	24/06/2019	24/08/2020
Receiver	Agilent Technologies	E4440A	5824	18/04/2018	18/06/2020
Receiver	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Shielded enclosure	RAY PROOF	C.V1	1123		
Shielded enclosure	COMTEST	SAC 3m	14494	14/02/2017	14/04/2020
Software	Nexio		0000		
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Testo	608-H2	12269	27/11/2017	27/01/2020
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

BAT-EMC software version: V3.18.0.26

Blank cells = Permanent validity

TEST SETUP PHOTO(S) – EUT POSITION FOR FREQ< 1GHZ



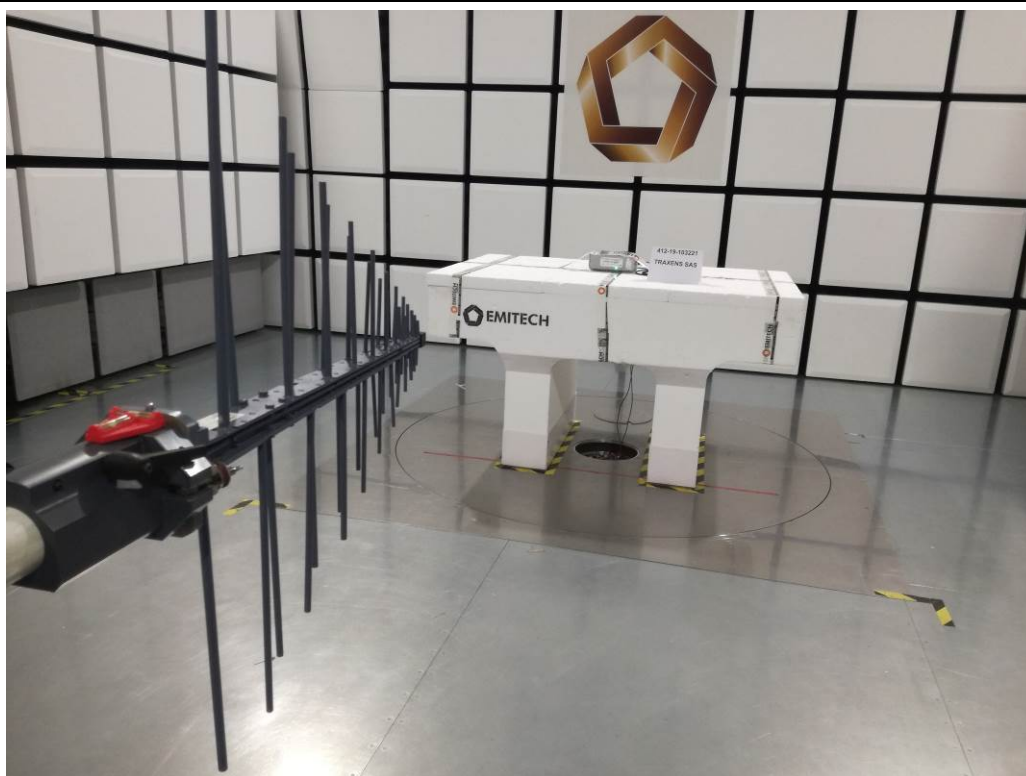
TEST SETUP PHOTO(S) – EUT POSITION FOR FREQ > 1GHZ



TEST SETUP PHOTO(S) – FREQ < 200MHz



TEST SETUP PHOTO(S) – 200MHz < FREQ < 1GHz



TEST SETUP PHOTO(S) – 1GHz < FREQ < 18GHz



TEST SETUP PHOTO(S) – 18GHz < FREQ



TRANSMITTER RADIATED SPURIOUS EMISSIONS - TABULATED RESULTS				
TX MODE - BLE - ALL CHANNELS FOR FREQ < 1GHz				EMI4611
Frequency (MHz)	Polarization	Level Peak (dBµV/m)	Limit Qpeak (dBµV/m)	Margin dB
30.768	Vertical	25.26	40	14.74
34.504	Vertical	25.93	40	14.07
35.458	Vertical	26.38	40	13.62
36.33	Vertical	25.57	40	14.43
77.839	Vertical	24.21	40	15.79
103.865	Horizontal	27.42	43.52	16.1
215.92	Vertical	27.17	43.52	16.35
236.04	Horizontal	31.03	46.02	14.99
311.146	Horizontal	32.96	46.02	13.06

TRANSMITTER RADIATED SPURIOUS EMISSIONS - TABULATED RESULTS						
TX MODE - BLE - LOW CHANNEL FOR 1GHz > FREQ > 18GHz					EMI4601	
Frequency (MHz)	Polarization	Level Peak (dBµV/m)	Level Avg (dBµV/m)	Limit Peak (dBµV/m)	Limit Avg (dBµV/m)	Margin dB
4803.975	Vertical	45.74	N/A	73.98	53.98	8.24
7206.151	Vertical	56.52	N/A	83.50 (20dBc)	N/A	26.98
9608.326	Vertical	48.68	N/A	83.50 (20dBc)	N/A	34.82
12010.501	Vertical	44.43	N/A	73.98	53.98	9.55
4803.975	Horizontal	44.55	N/A	73.98	53.98	9.43
7206.151	Horizontal	52.3	N/A	83.50 (20dBc)	N/A	31.2
9608.326	Horizontal	45.14	N/A	83.50 (20dBc)	N/A	38.36
12008.626	Horizontal	45.34	N/A	73.98	53.98	8.64

TRANSMITTER RADIATED SPURIOUS EMISSIONS - TABULATED RESULTS						
TX MODE - BLE - MID CHANNEL FOR 1GHz > FREQ > 18GHz					EMI4605	
Frequency (MHz)	Polarization	Level Peak (dBµV/m)	Level Avg (dBµV/m)	Limit Peak (dBµV/m)	Limit Avg (dBµV/m)	Margin dB
1895.362	Vertical	48.81	N/A	73.98	53.98	5.17
4878.985	Vertical	44.56	N/A	73.98	53.98	9.42
7320.540	Vertical	55.53	50.8	73.98	53.98	3.18
9760.220	Vertical	50.72	N/A	83.70 (20dBc)	N/A	32.98
12201.775	Vertical	45.87	N/A	73.98	53.98	8.11
4878.985	Horizontal	43.63	N/A	73.98	53.98	10.35
7320.540	Horizontal	51.31	N/A	73.98	53.98	2.67
9760.220	Horizontal	49.37	N/A	83.70 (20dBc)	N/A	34.33
12201.775	Horizontal	46.35	N/A	73.98	53.98	7.63

TRANSMITTER RADIATED SPURIOUS EMISSIONS - TABULATED RESULTS						
TX MODE - BLE - HIGH CHANNEL FOR 1GHZ > FREQ > 18GHZ					EMI4606	
Frequency (MHz)	Polarization	Level Peak (dBμV/m)	Level Avg (dBμV/m)	Limit Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin dB
4959.62	Vertical	42.6	N/A	73.98	53.98	11.38
7438.68	Vertical	56.82	50.9	73.98	53.98	3.08
9919.615	Vertical	52.59	N/A	83.61 (20dBc)	N/A	31.02
12400.55	Vertical	48.12	N/A	73.98	53.98	5.86
4959.62	Horizontal	44.22	N/A	73.98	53.98	9.76
7440.555	Horizontal	57.34	50.9	73.98	53.98	3.08
9919.615	Horizontal	51.35	N/A	83.61 (20dBc)	N/A	32.26
12398.675	Horizontal	46.89	N/A	73.98	53.98	7.09

RADIATED SPURIOUS EMISSIONS (TRANSMITTER) - TABULATED RESULTS						
TX MODE - BLE - LOW CHANNEL FOR FREQ > 18GHZ					EMI4602	
Frequency (MHz)	Polarization	Level Peak (dBμV/m)	Level Avg (dBμV/m)	Limit Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin dB
N/A	N/A	N/A	N/A	83.52	63.52	N/A

No spurious emissions were detected.

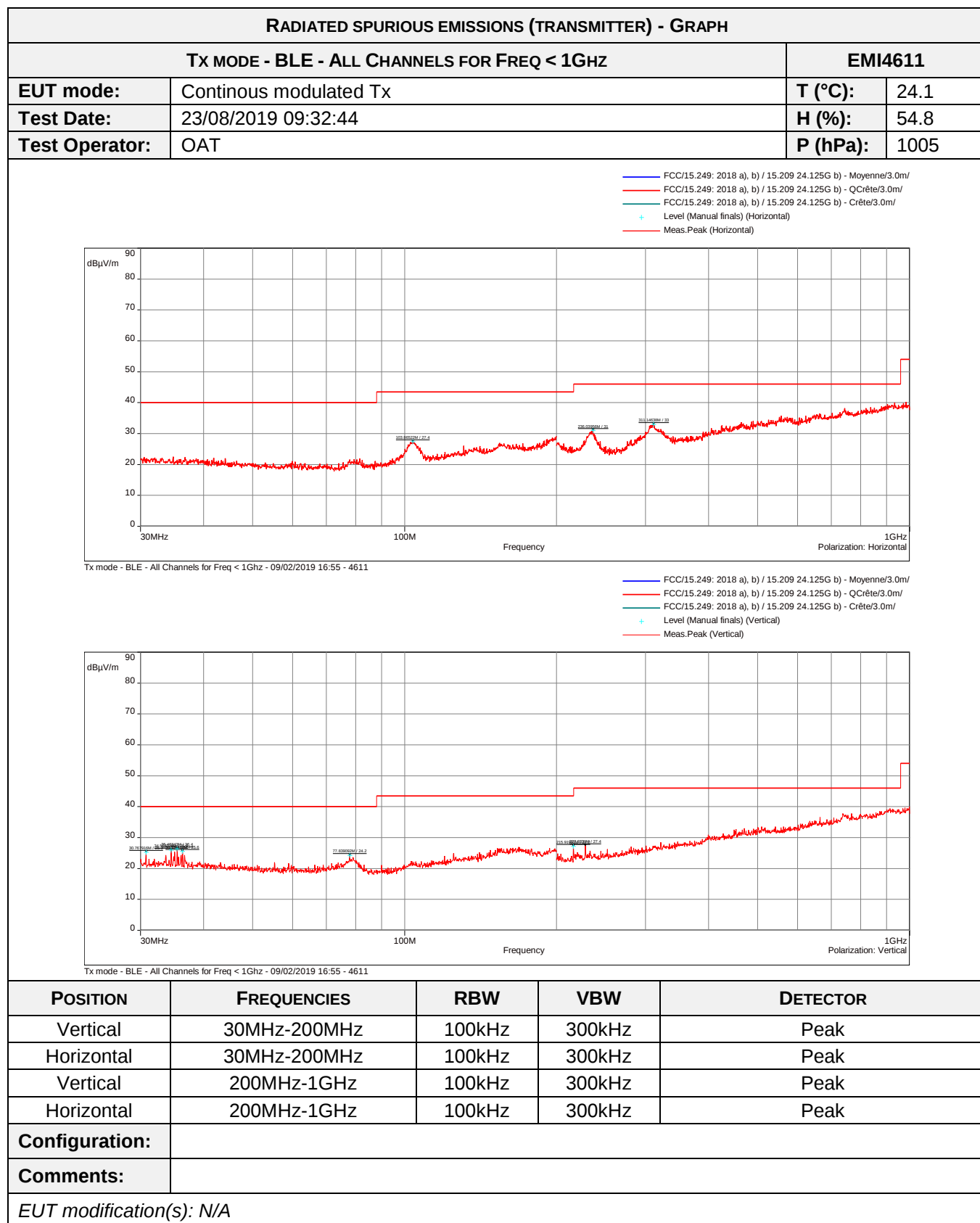
RADIATED SPURIOUS EMISSIONS (TRANSMITTER) - TABULATED RESULTS						
TX MODE - BLE - MID CHANNEL FOR FREQ > 18GHZ					EMI4609	
Frequency (MHz)	Polarization	Level Peak (dBμV/m)	Level Avg (dBμV/m)	Limit Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin dB
N/A	N/A	N/A	N/A	83.52	63.52	N/A

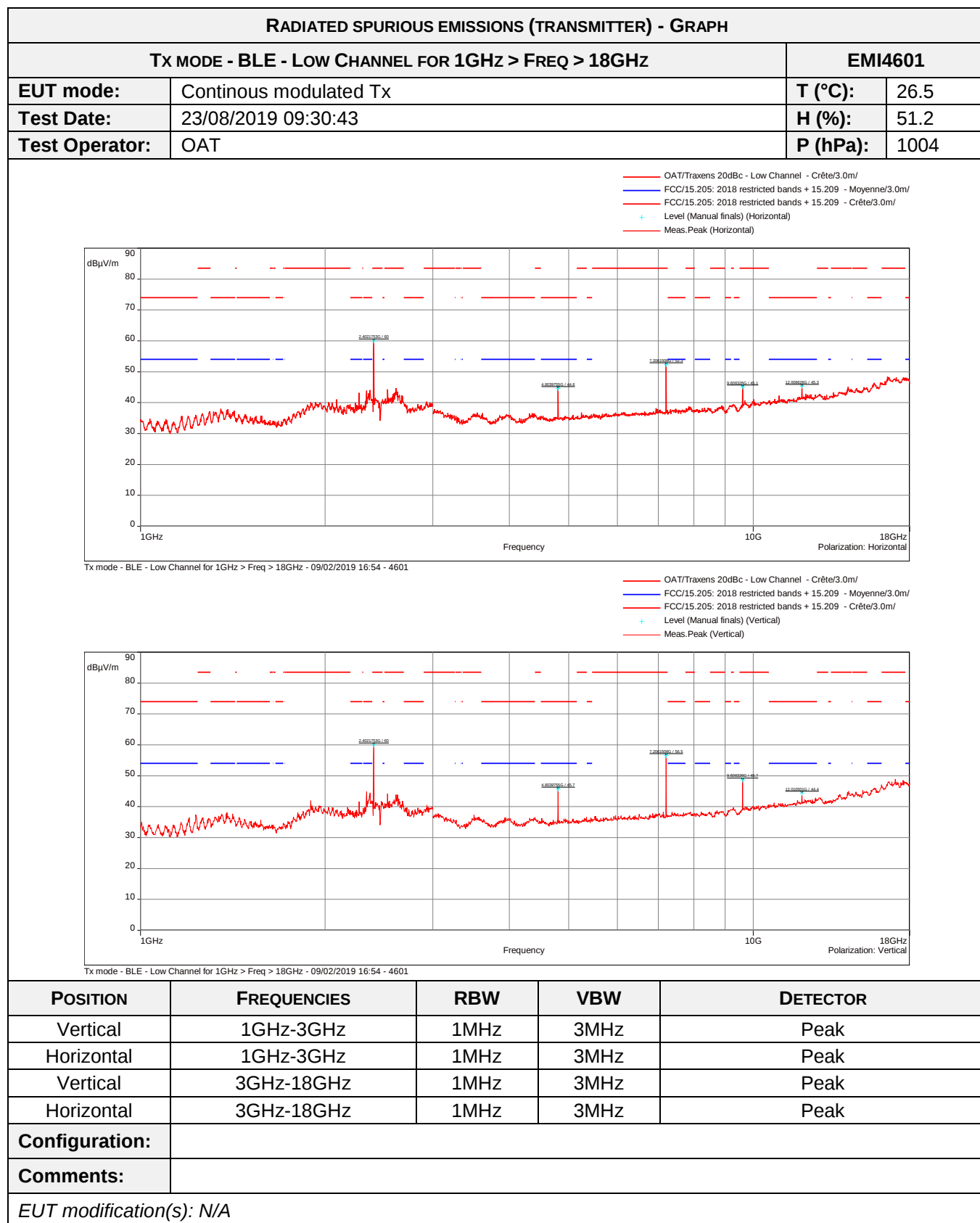
No spurious emissions were detected.

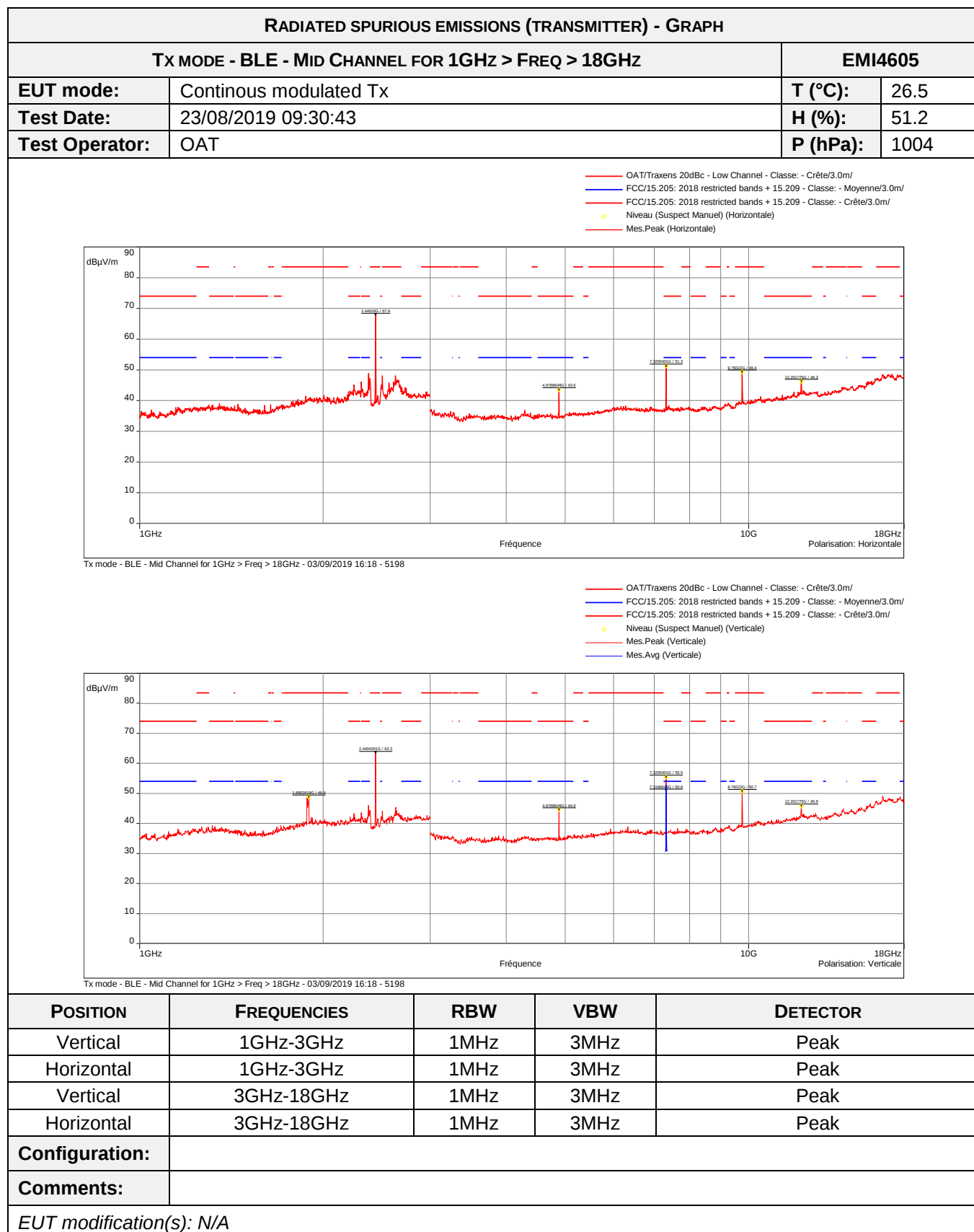
RADIATED SPURIOUS EMISSIONS (TRANSMITTER) - TABULATED RESULTS						
TX MODE - BLE - HIGH CHANNEL FOR FREQ > 18GHZ					EMI4607	
Frequency (MHz)	Polarization	Level Peak (dBμV/m)	Level Avg (dBμV/m)	Limit Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin dB
N/A	N/A	N/A	N/A	83.52	63.52	N/A

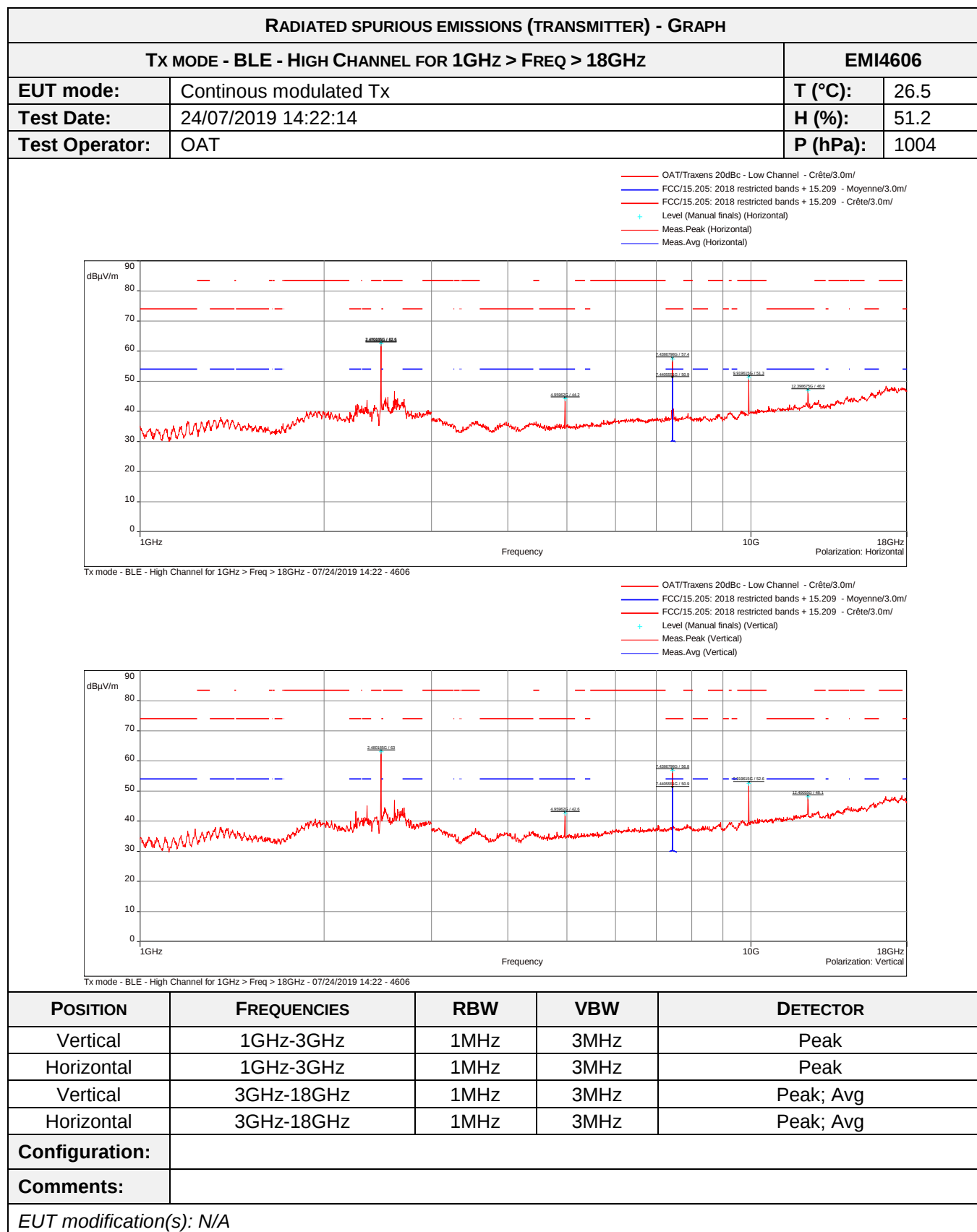
No spurious emissions were detected.

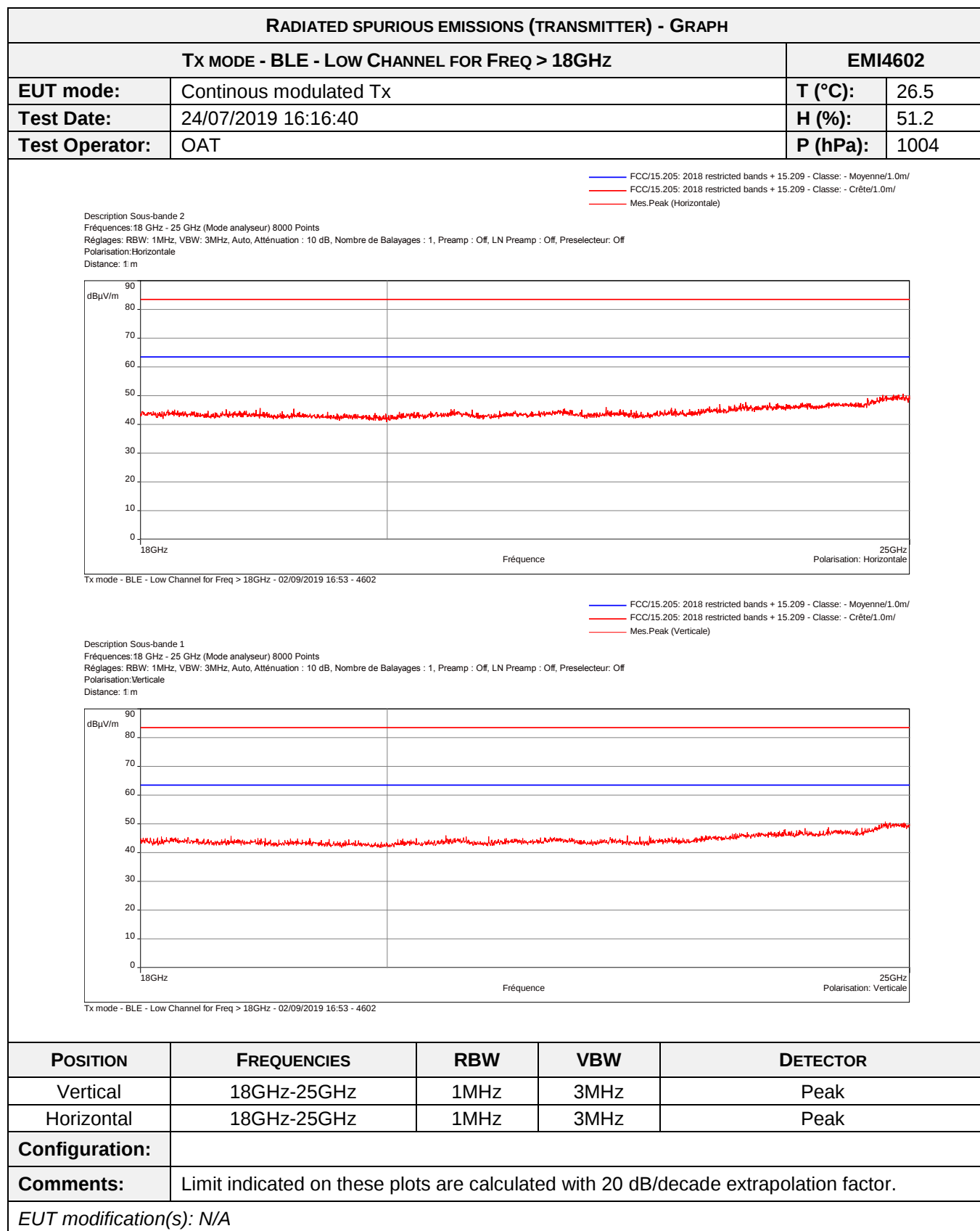
Spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

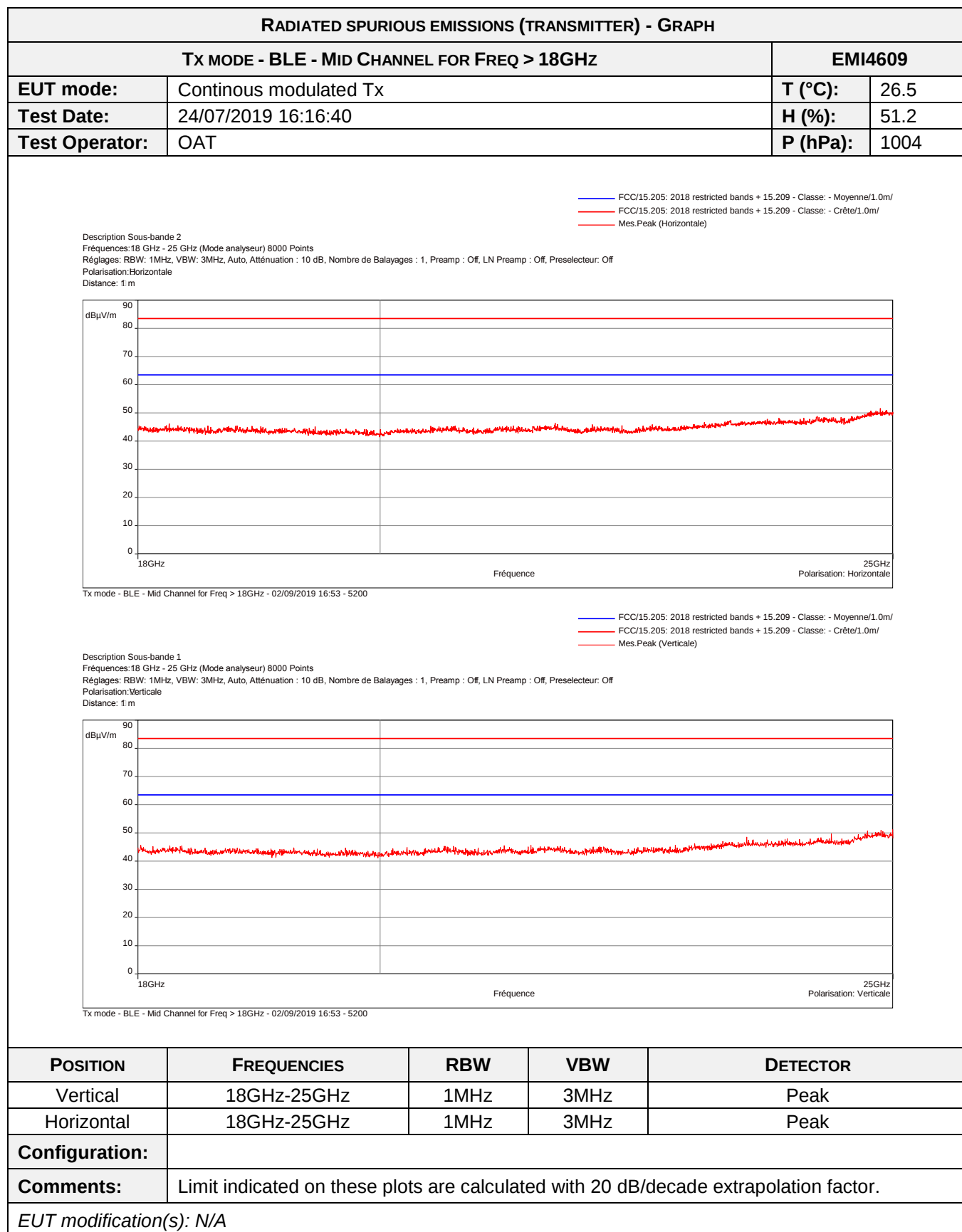


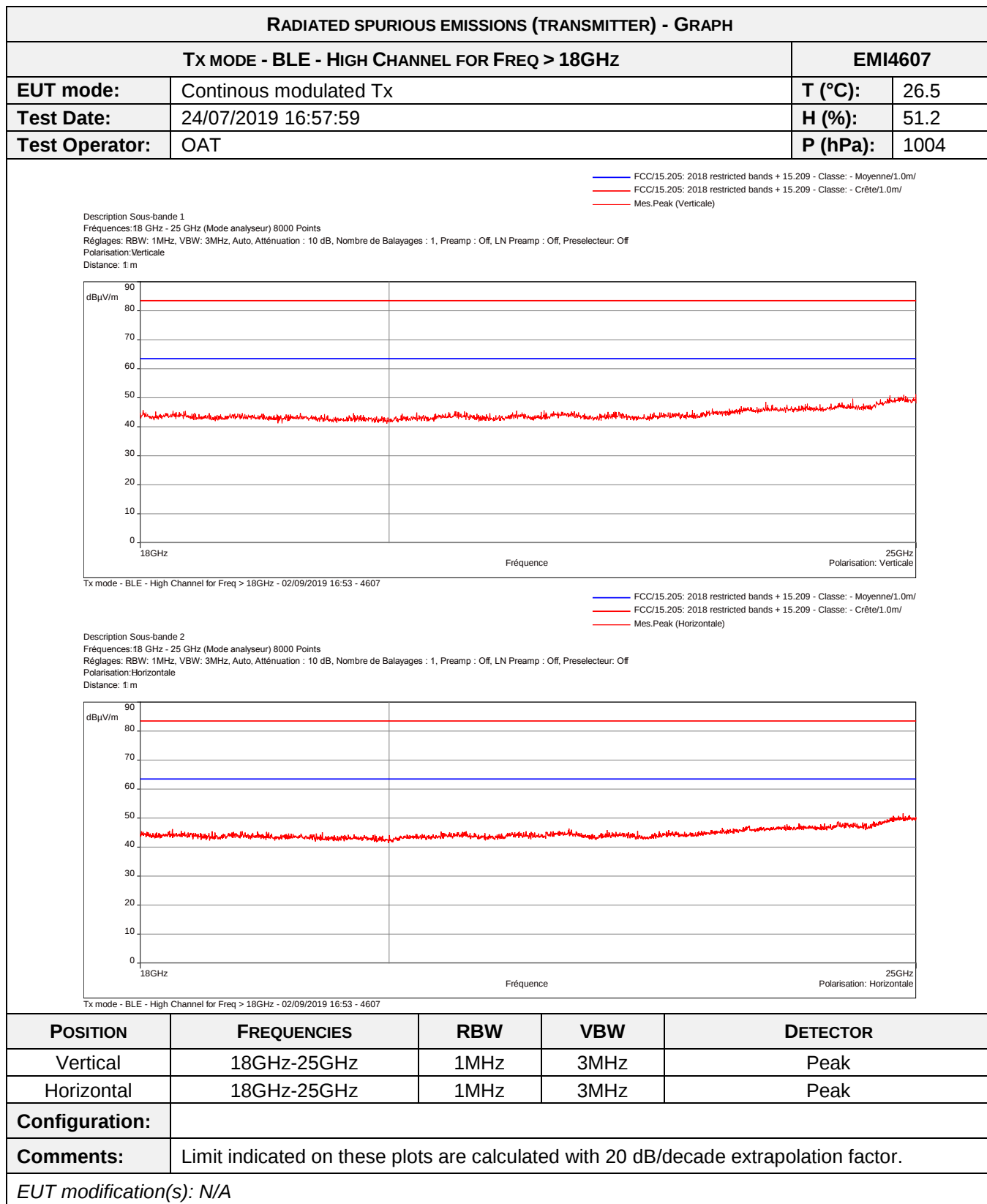












8.4. Band-edge compliance

Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	FCC part 15.247 subclause d) and RSS-247
Test description: d) In any 100 kHz bandwidth outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. EUT is connected to the measuring receiver via 50Ω attenuator(s). Only the highest levels are recorded.	

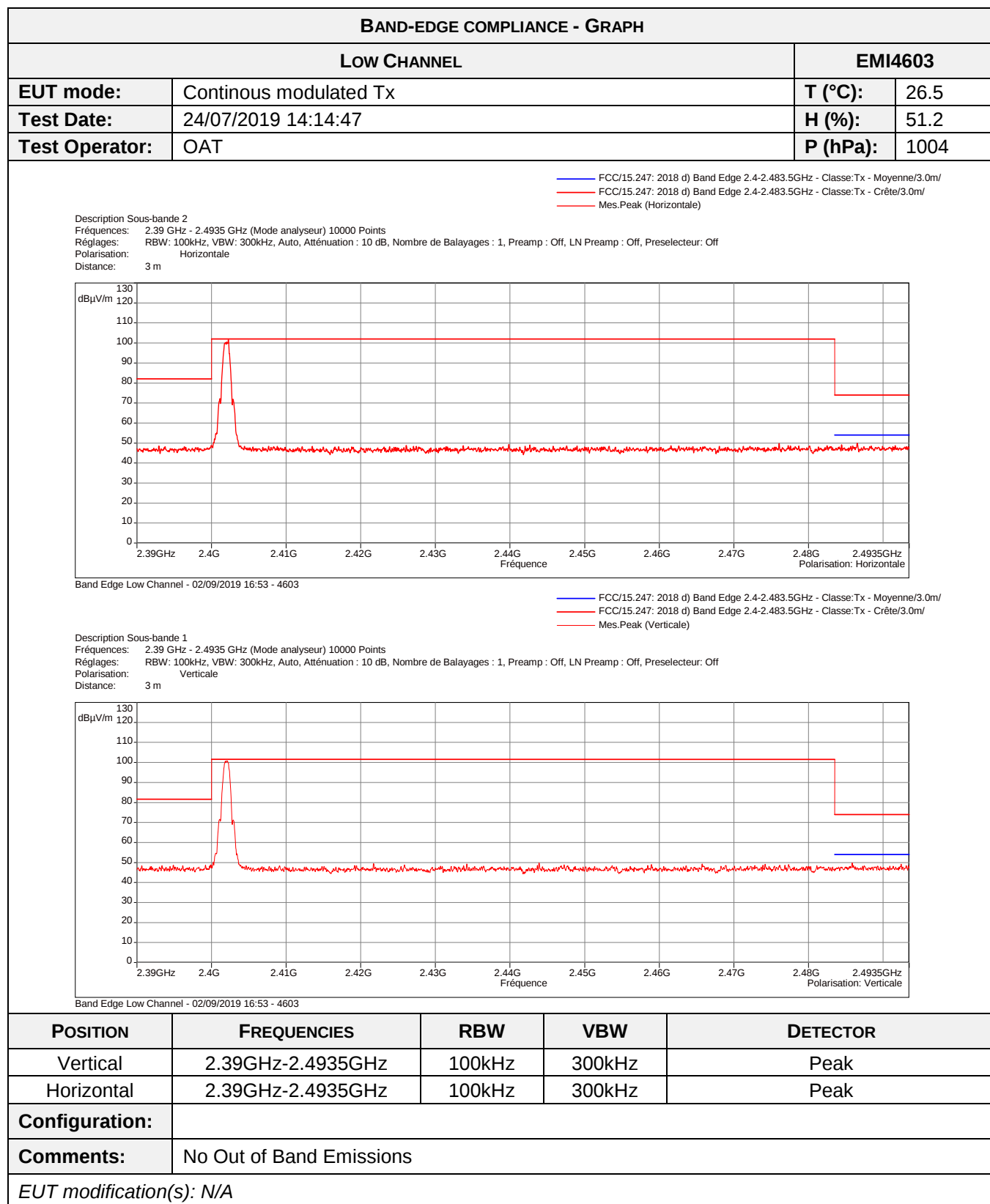
TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
Band Edge Low Channel	2.39GHz-2.4935GHz	15.247	EMI4603	PASS
Band Edge High Channel	2.39GHz-2.4935GHz	15.247	EMI4604	PASS

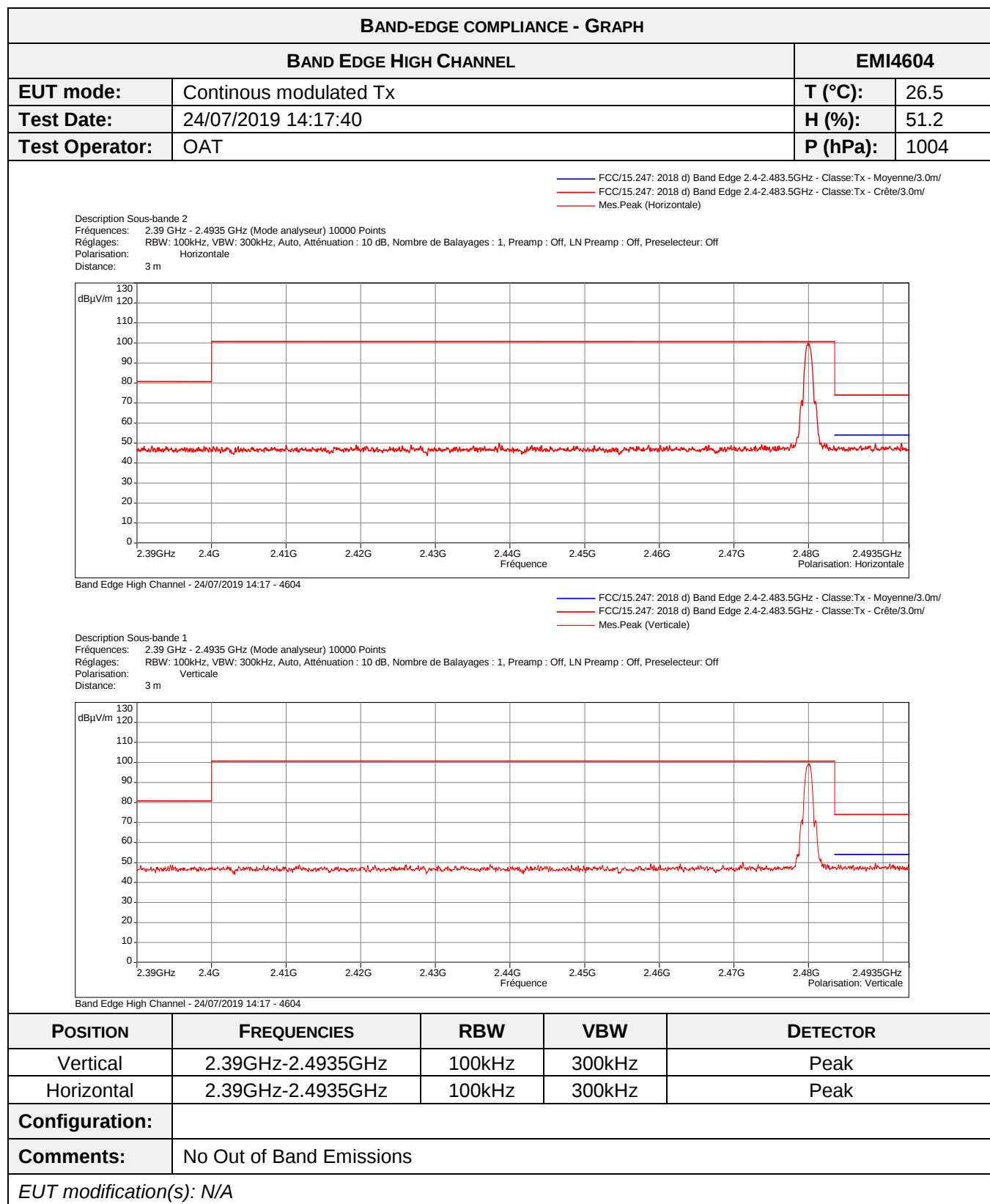
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	See Graph(es)
Relative Humidity	20 to 75 %	See Graph(es)
Atmospheric pressure	N/A	See Graph(es)
Test method deviation: N/A		
Supplementary information: Limit at -20dBc is calculated with an eirp measurement with an RBW at 1MHz.		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	ETS-Lindgren	3117	8387	23/07/2019	23/09/2022
Cable	MegaPhase	TM18-N1N1-118	12841	09/05/2018	09/07/2020
Cable	MegaPhase	TM18-N1N1-197	12840	09/05/2018	09/07/2020
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Receiver	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Shielded enclosure	RAY PROOF	C.V1	1123		
Software	Nexio		0000		
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

BAT-EMC software version: V3.18.0.26

Blank cells = Permanent validity





8.5. Maximum peak conducted power of the intentional radiator

a) NORMAL TESTS CONDITIONS

Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	FCC part 15.247, RSS-247 and ANSI C63.4: 2013
Test description: b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode. For conducted measurement, EUT is connected to the measuring receiver via 50Ω attenuator(s). Only the highest levels are recorded. For radiated measurement, EUT is set on an insulating support at 150cm above the ground reference plane. Measurement are done on a normalized test site by the substitution method. The test antenna is oriented in the two polarizations (vertical and horizontal), and the product is rotated at 360° in the horizontal plane (See photo(s) for initial position of the EUT(0°)). If applicable the test antenna was raised and lowered through the specified range of height until a maximum signal level is detected. For portable equipments a research of maximum level is done on the 3 axes. Only the highest levels are recorded.	

TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
EIRP- BLE - Low Channel	2.4GHz-2.404GHz	1W (30dBm)	EMI5181	PASS
EIRP- BLE - Mid Channel	2.4375GHz-2.4425GHz	1W (30dBm)	EMI5183	PASS
EIRP- BLE - High Channel	2.478GHz-2.482GHz	1W (30dBm)	EMI5182	PASS

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	See Graph(es)
Relative Humidity	20 to 75 %	See Graph(es)
Atmospheric pressure	N/A	See Graph(es)
Test method deviation: EUT has its dedicated internal PCB antenna, due to this, this measurement was done in radiated by the substitution method.		
Supplementary information: N/A		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	ETS-Lindgren	3117	8387	23/07/2019	23/09/2022
Attenuator	EMITECH	SUB.V1-H	14780	09/01/2019	09/03/2020
Attenuator	EMITECH	SUB.V1-V	14781	09/01/2019	09/03/2020
Cable	Huber + Suhner	SF102K	16041	28/02/2019	28/04/2021
Cable	MegaPhase	TM18-N1N1-118	12841	09/05/2018	09/07/2020
Cable	MegaPhase	TM18-N1N1-197	12840	09/05/2018	09/07/2020

CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Receiver	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Shielded enclosure	RAY PROOF	C.V1	1123		
Software	Nexio		0000		
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

BAT-EMC software version: V3.18.0.26

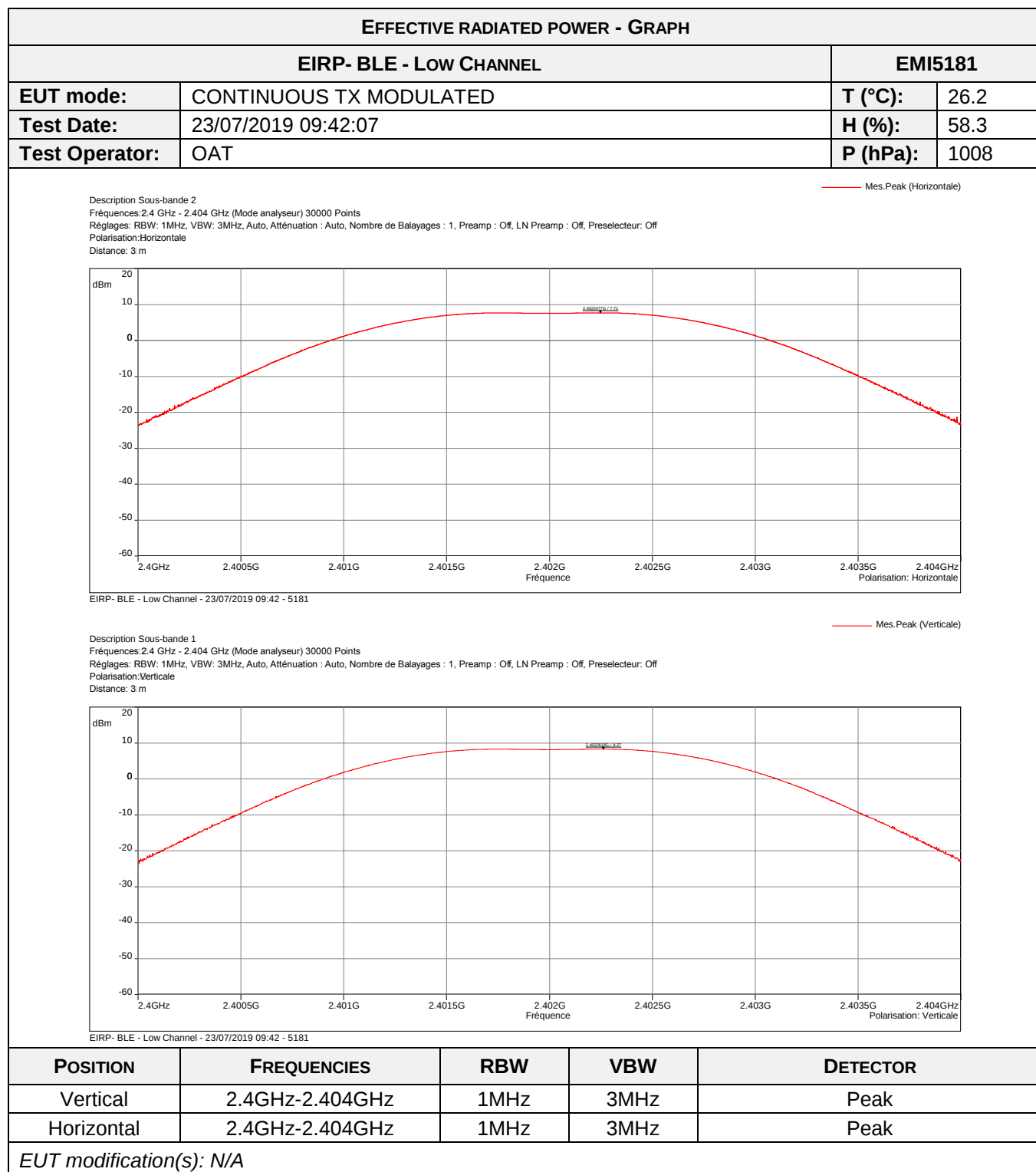
Blank cells = Permanent validity

TEST SETUP PHOTO(S) – EUT POSITION FOR FREQ > 1GHZ

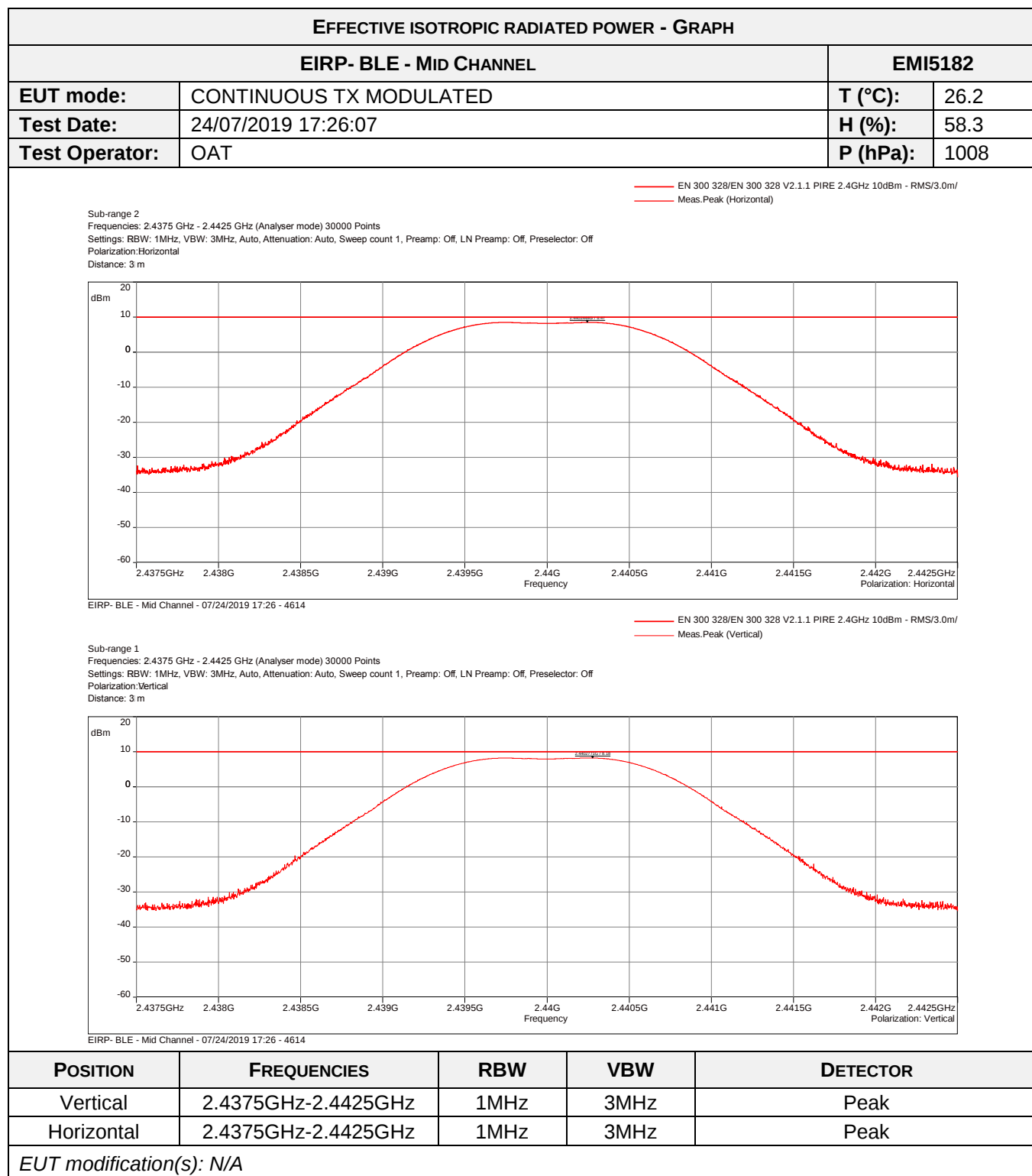


TEST SETUP PHOTO(S) - FREQ > 1GHZ

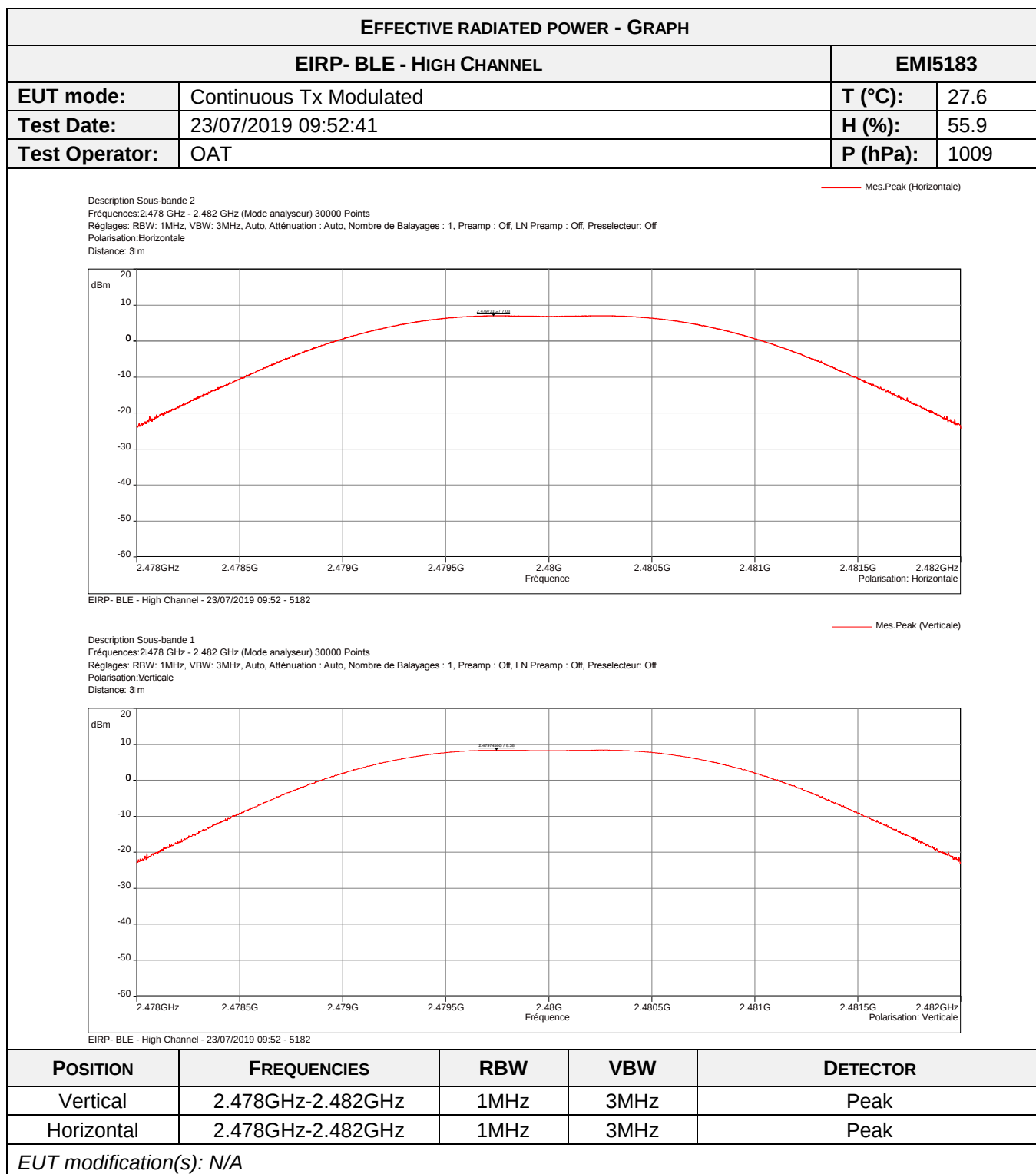




EFFECTIVE RADIATED POWER - TABULATED RESULTS			
EIRP- BLE - Low CHANNEL			EMI5181
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Polarization	Level _{eirp} (dBm)	Limit _{eirp} (dBm)
2402.000	Vertical	8.27	36
2402.000	Horizontal	7.71	36



EFFECTIVE ISOTROPIC RADIATED POWER - TABULATED RESULTS			
EIRP- BLE - Mid CHANNEL			EMI5182
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Polarization	Level _{eirp} (dBm)	Limit _{eirp} (dBm)
2440	Vertical	8.18	36
2440	Horizontal	8.47	36



EFFECTIVE RADIATED POWER - TABULATED RESULTS			
EIRP- BLE - HIGH CHANNEL			EMI5183
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency (MHz)	Polarization	Level _{eirp} (dBm)	Limit _{eirp} (dBm)
2480.000	Vertical	8.38	36
2480.000	Horizontal	7.03	36

b) EXTREMES TESTS CONDITIONS

Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	FCC part 15.247 , RSS-247 & ANSI C63.10: 2013
General test setup: EUT is set inside the climatic enclosure. EIRP measurements are repeated in extreme test conditions with the power levels correlated with the maximum power measured in normal conditions.	

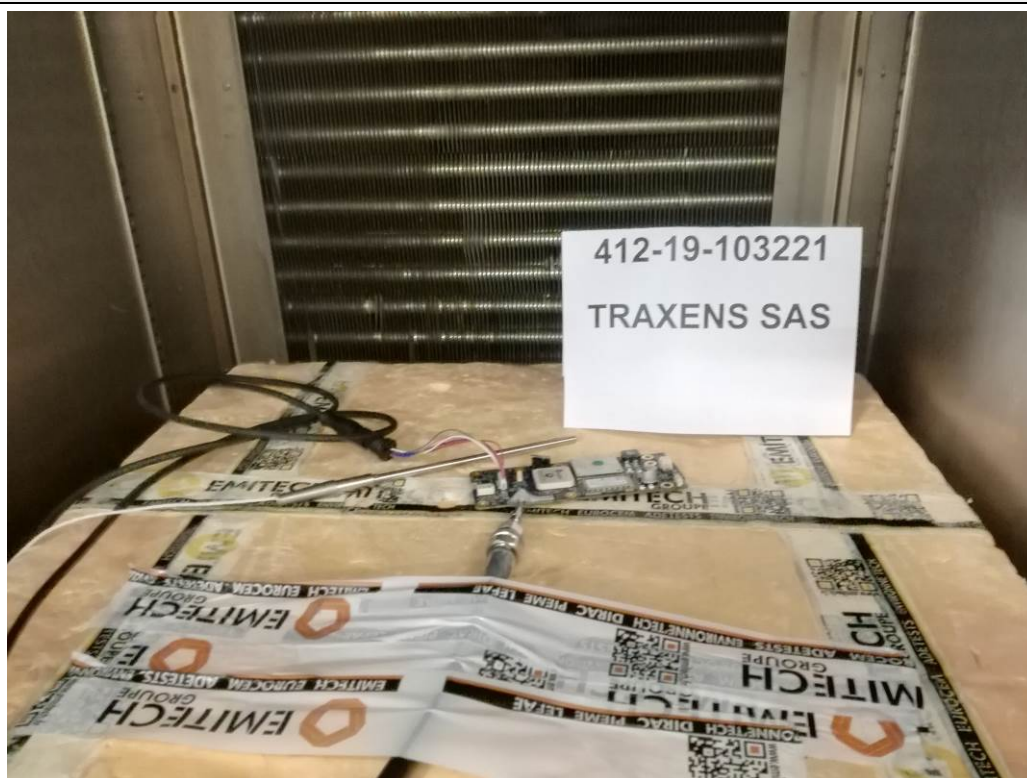
TEST CASE	EUT MODE	SEVERITY	RESULT TAB.	VERDICT
Low channel / 25°C	Tx CW	1W (30dBm)	EMI5189	PASS
Low channel / 85°C	Tx CW	1W (30dBm)	EMI5190	PASS
Low channel / -40°C	Tx CW	1W (30dBm)	EMI5191	PASS
Mid channel / 25°C	Tx CW	1W (30dBm)	EMI4784	PASS
Mid channel / 85°C	Tx CW	1W (30dBm)	EMI4785	PASS
Mid channel / -40°C	Tx CW	1W (30dBm)	EMI4786	PASS
High channel / 25°C	Tx CW	1W (30dBm)	EMI5195	PASS
High channel / 85°C	Tx CW	1W (30dBm)	EMI5196	PASS
High channel / -40°C	Tx CW	1W (30dBm)	EMI5197	PASS

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	<i>see tabulated results</i>
Relative Humidity	20 to 75 %	<i>see tabulated results</i>
Atmospheric pressure	N/A	<i>see tabulated results</i>
Test method deviation: N/A		
Supplementary information:		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412720124	4391	01/02/2018	01/04/2020
Cable	N	3m	16428	04/05/2019	04/07/2021
Cable	Huber + Suhner	SF102K	16041	28/02/2019	28/04/2021
Climatic enclosure	Secasi	SM600C	1670		
Spectrum analyzer	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Thermometer contactless	GHM Greisinger	GMH 3710	12968	11/02/2019	11/04/2020

Blank cells = Permanent validity

TEST SETUP PHOTO(S)



EFFECTIVE RADIATED POWER - TABULATED RESULTS				
TEST CASE	FREQUENCY	LEVEL _{EIRP}	LIMIT _{EIRP}	RESULT TAB.
Low channel / 25°C	2402 MHz	8.27 dBm	36dBm	EMI5189
Low channel / 85°C	2402 MHz	8.75 dBm	36dBm	EMI5190
Low channel / -40°C	2402 MHz	8.4 dBm	36dBm	EMI5191
Mid channel / 25°C	2440 MHz	8.47 dBm	36dBm	EMI4784
Mid channel / 85°C	2440 MHz	8.18 dBm	36dBm	EMI4785
Mid channel / -40°C	2440 MHz	9.51 dBm	36dBm	EMI4786
High channel / 25°C	2480 MHz	8.38 dBm	36dBm	EMI5195
High channel / 85°C	2480 MHz	7.80 dBm	36dBm	EMI5196
High channel / -40°C	2480 MHz	9.72 dBm	36dBm	EMI5197

EUT MODIFICATIONS	OPERATOR	TEST DATE	RESULT TAB.
	OAT	23/07/2019	EMI5189

8.6. 6dB Bandwidth For Digitally Modulation Systems

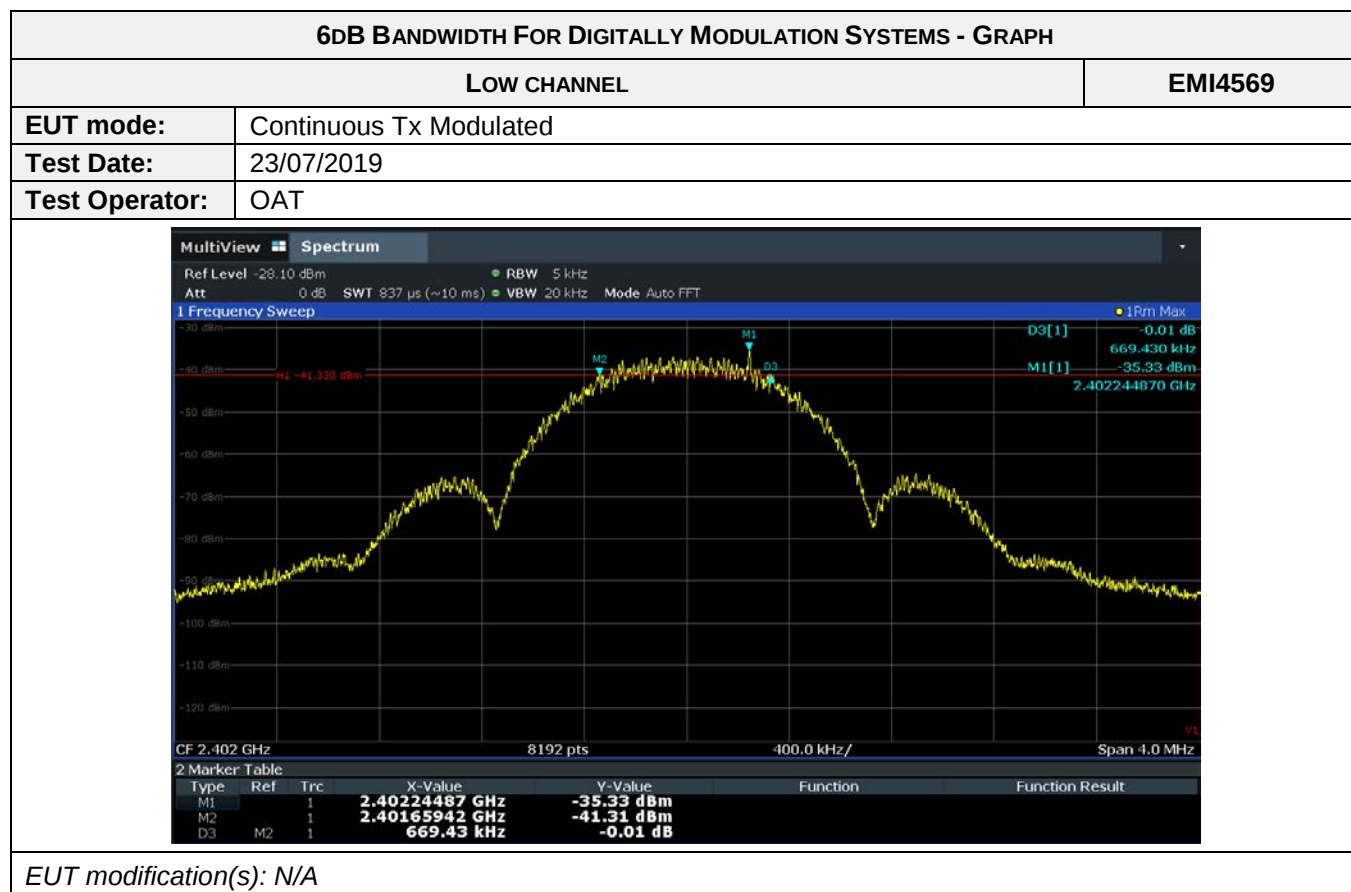
Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	ANSI C63.10: 2013
Test description: Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. EUT is connected to the measuring receiver via 50Ω attenuator(s). Tests are done in max-hold mode in order to capture all channels.	

TESTED CHANNEL	RESULT	SEVERITY	RESULT TAB.	VERDICT
6dB Bandwidth - Low channel	669.43 kHz	>500kHz	EMI4569	PASS
6dB Bandwidth - Mid channel	563.96 kHz	>500kHz	EMI4570	PASS
6dB Bandwidth - High channel	595.21 kHz	>500kHz	EMI4571	PASS

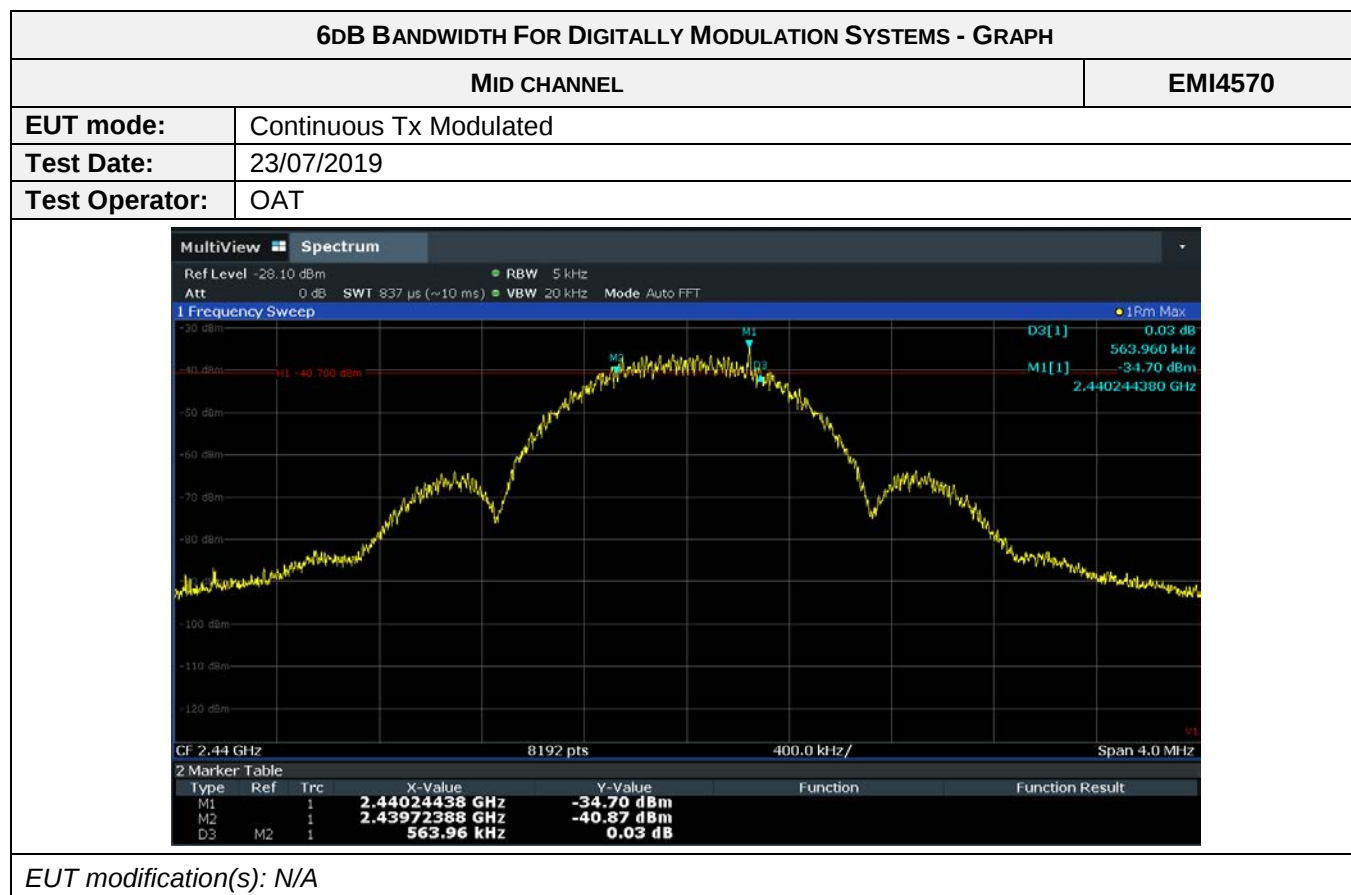
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	27.7 °C
Relative Humidity	20 to 75 %	55.8 %
Atmospheric pressure	N/A	1009 hPa
Test method deviation: N/A		
Supplementary information: EUT power supply is replaced by a stabilized power supply.		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412710124	16491	25/06/2019	25/08/2021
Cable	STORM MICROWAVE	N-1.5m	10263	29/10/2018	29/12/2020
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Spectrum analyzer	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

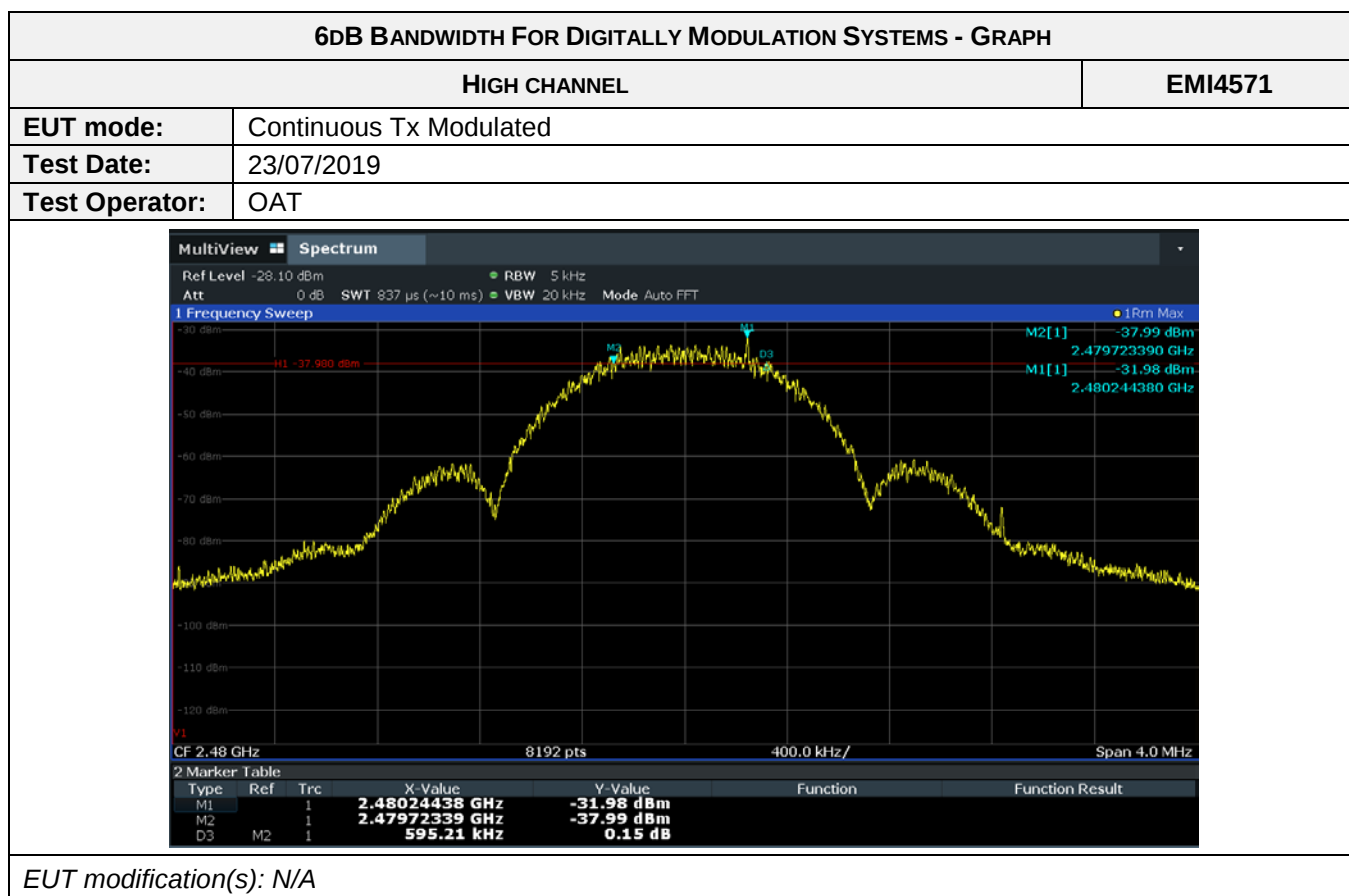
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6dB BANDWIDTH FOR DIGITALLY MODULATION SYSTEMS - TABULATED RESULTS			
LOW CHANNEL			EMI4569
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f _{Low}	f _{High}	6dB Bandwidth	Limit
-	-	669.43 kHz	> 500kHz



6dB BANDWIDTH FOR DIGITALLY MODULATION SYSTEMS - TABULATED RESULTS			
MID CHANNEL			EMI4570
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f _{Low}	f _{High}	6dB Bandwidth	Limit
-	-	563.96 kHz	> 500kHz



6dB BANDWIDTH FOR DIGITALLY MODULATION SYSTEMS - TABULATED RESULTS			
HIGH CHANNEL			EMI4571
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f _{Low}	f _{High}	6dB Bandwidth	Limit
-	-	595.21 kHz	> 500kHz

8.7. Occupied Bandwidth

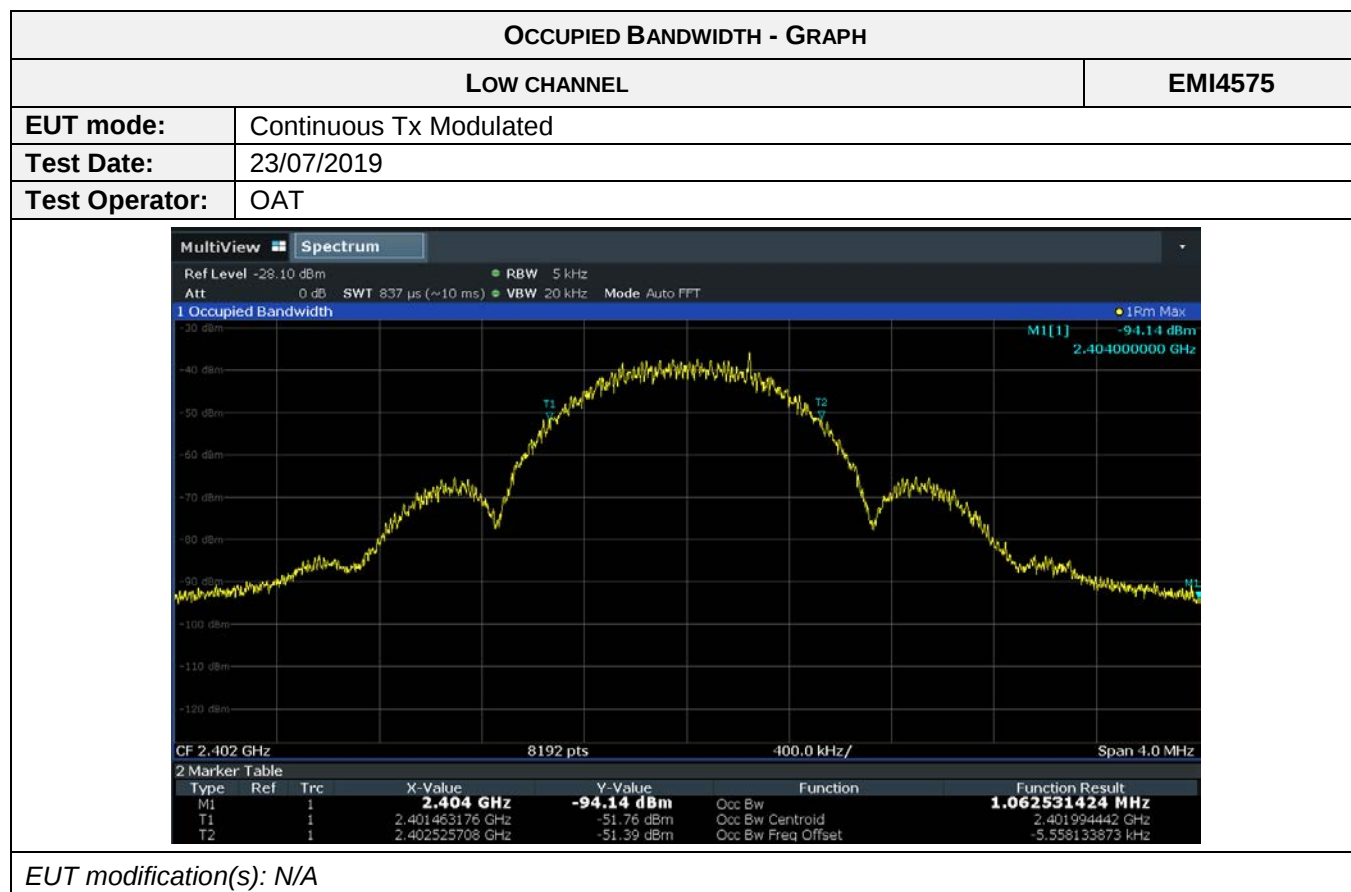
Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	ANSI C63.10 :2013
Test description: The occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as β, which, in cases of symmetrical spectra, splits up into $\beta/2$ on each side of the spectrum. Unless otherwise specified, $\beta/2$ is taken as 0,5 % as described in Figure 3 of the standard. The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions. For EUT without dedicated or integral antenna, EUT is connected to the measuring receiver via 50Ω attenuator(s). Radiated power limit applies to the maximum measured conducted power value adjusted by the antenna gain. For EUT with integral or dedicated antenna, measurements are done on a normalized test site by the substitution method. EUT is set on an insulating support at N/Acm above the ground reference plane. Then EUT is set inside the climatic enclosure. Measurements are repeated in extreme test conditions with the power levels correlated with the maximum effective radiated power measured in normal conditions.	

TESTED CHANNEL	OBW	SEVERITY	RESULT TAB.	VERDICT
Low channel	1.062531 MHz	> 500kHz	EMI4575	PASS
Mid channel	1.066372 MHz	> 500kHz	EMI4576	PASS
High channel	1.065893 MHz	> 500kHz	EMI4577	PASS

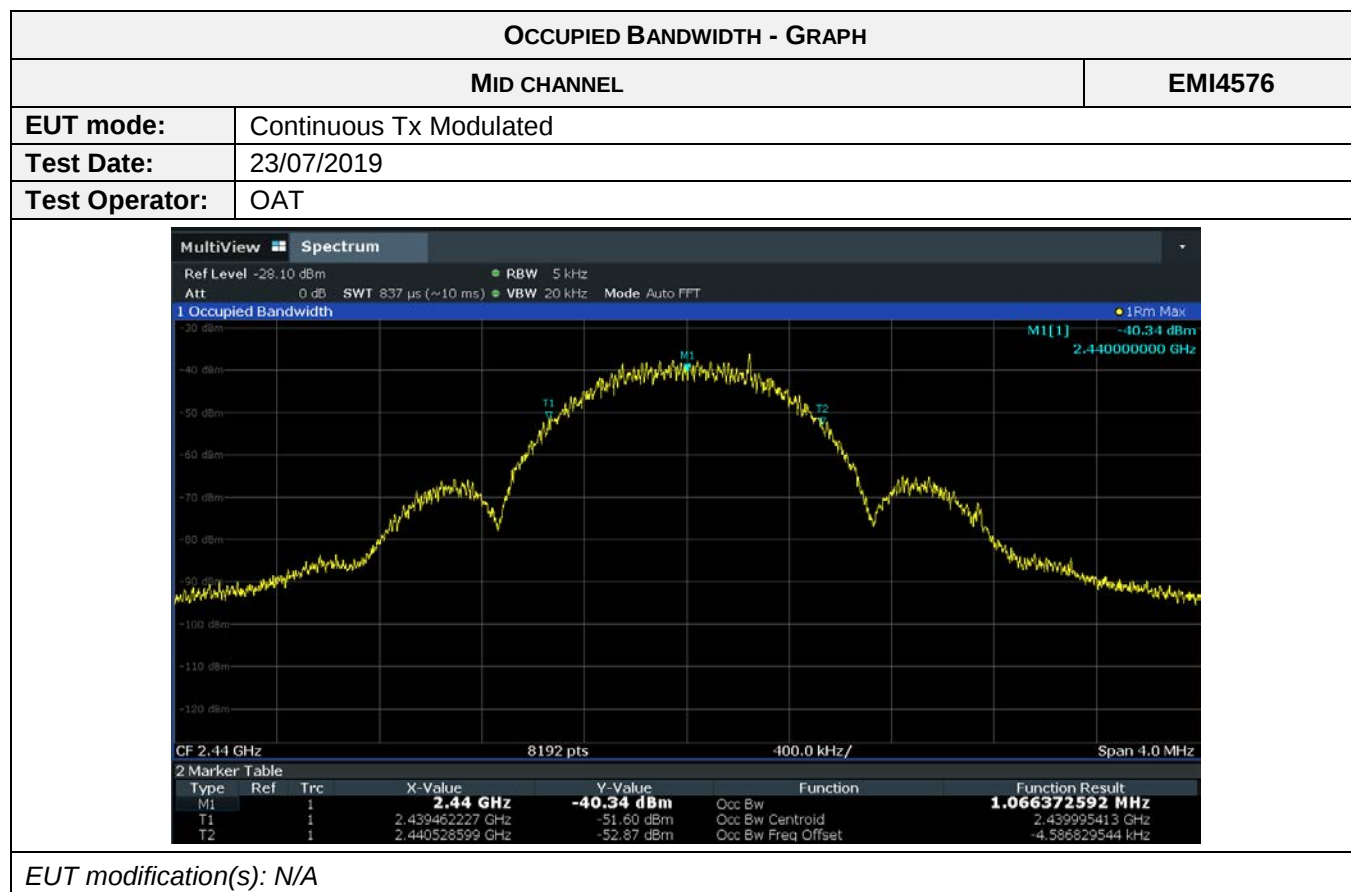
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	27.7 °C
Relative Humidity	20 to 75 %	55.8 %
Atmospheric pressure	N/A	1009 hPa
Test method deviation: N/A		
Supplementary information: EUT power supply is replaced by a stabilized power supply.		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412710124	16491	25/06/2019	25/08/2021
Cable	STORM MICROWAVE	N-1.5m	10263	29/10/2018	29/12/2020
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Spectrum analyzer	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

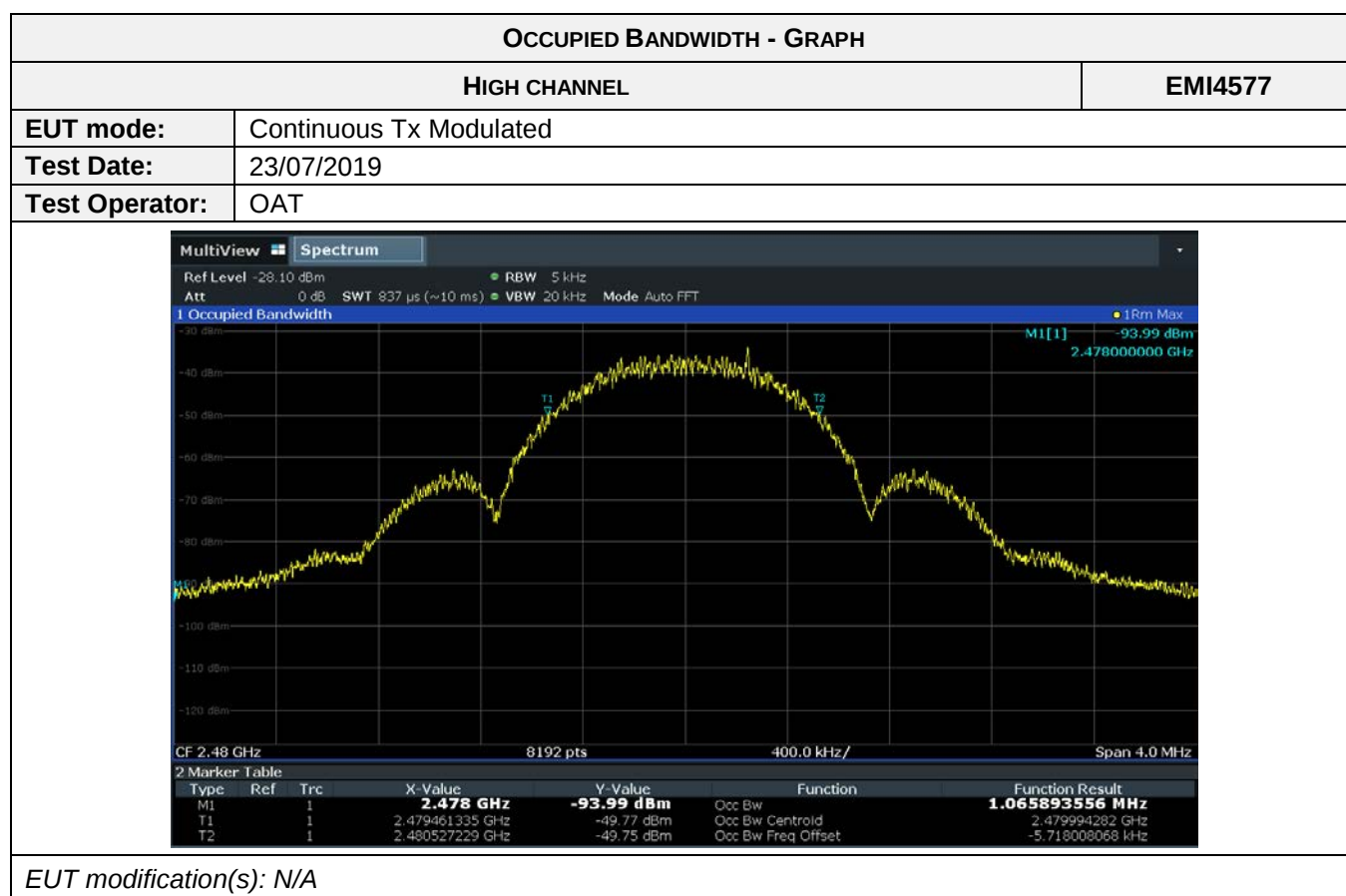
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OCCUPIED BANDWIDTH - TABULATED RESULTS			
LOW CHANNEL			EMI4575
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f _{Low}	f _{High}	OBW (f _{high} -f _{low})	Limit
2401.463176 MHz	2402.525708 MHz	1.062531 MHz	> 500kHz



OCCUPIED BANDWIDTH - TABULATED RESULTS			
MID CHANNEL			EMI4576
U _{Start} (start of the test):	24Vdc	U _{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f _{Low}	f _{High}	OBW (f _{high} -f _{low})	Limit
2439.462227 MHz	2440.528599 MHz	1.066372 MHz	> 500kHz



OCCUPIED BANDWIDTH - TABULATED RESULTS			
HIGH CHANNEL			EMI4577
U_{Start} (start of the test):	24Vdc	U_{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
f_{Low}	f_{High}	OBW (f_{high}-f_{low})	Limit
2479.461335 MHz	2480.527229 MHz	1.065893 MHz	> 500kHz

8.8. Power spectral density

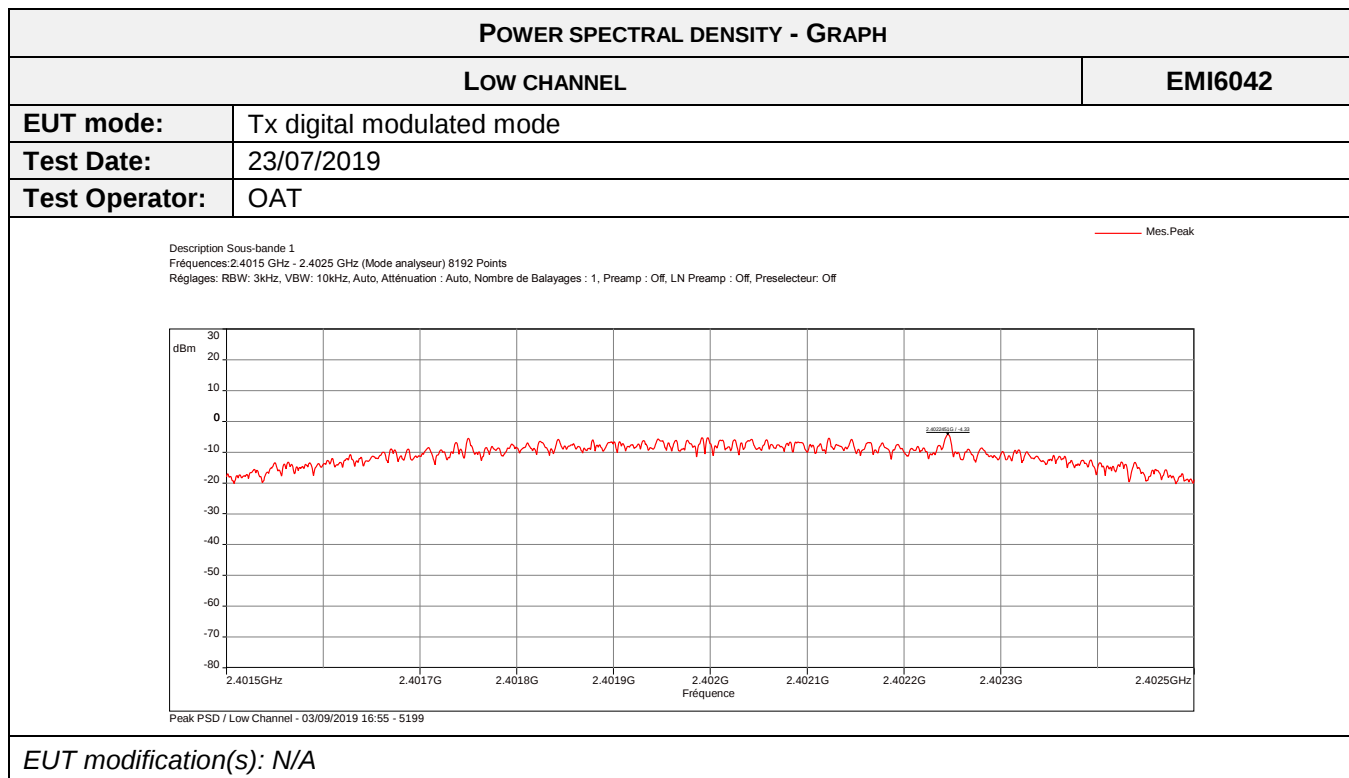
Reference standard:	FCC part 15 Radio part 15.247 and RSS-247
Test method:	FCC part 15.247, RSS-247 & ANSI C63.10: 2013
Test description: e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density. EUT is connected to the measuring receiver via 50Ω attenuator(s). Only the highest levels are recorded.	

TESTED CHANNEL	RESULT	SEVERITY	RESULT TAB.	VERDICT
Low channel	-4.33dBm/3kHz	8dBm/3kHz	EMI6040	PASS
Mid channel	-4.07dBm/3kHz	8dBm/3kHz	EMI6041	PASS
High channel	-1.34dBm/3kHz	8dBm/3kHz	EMI6042	PASS

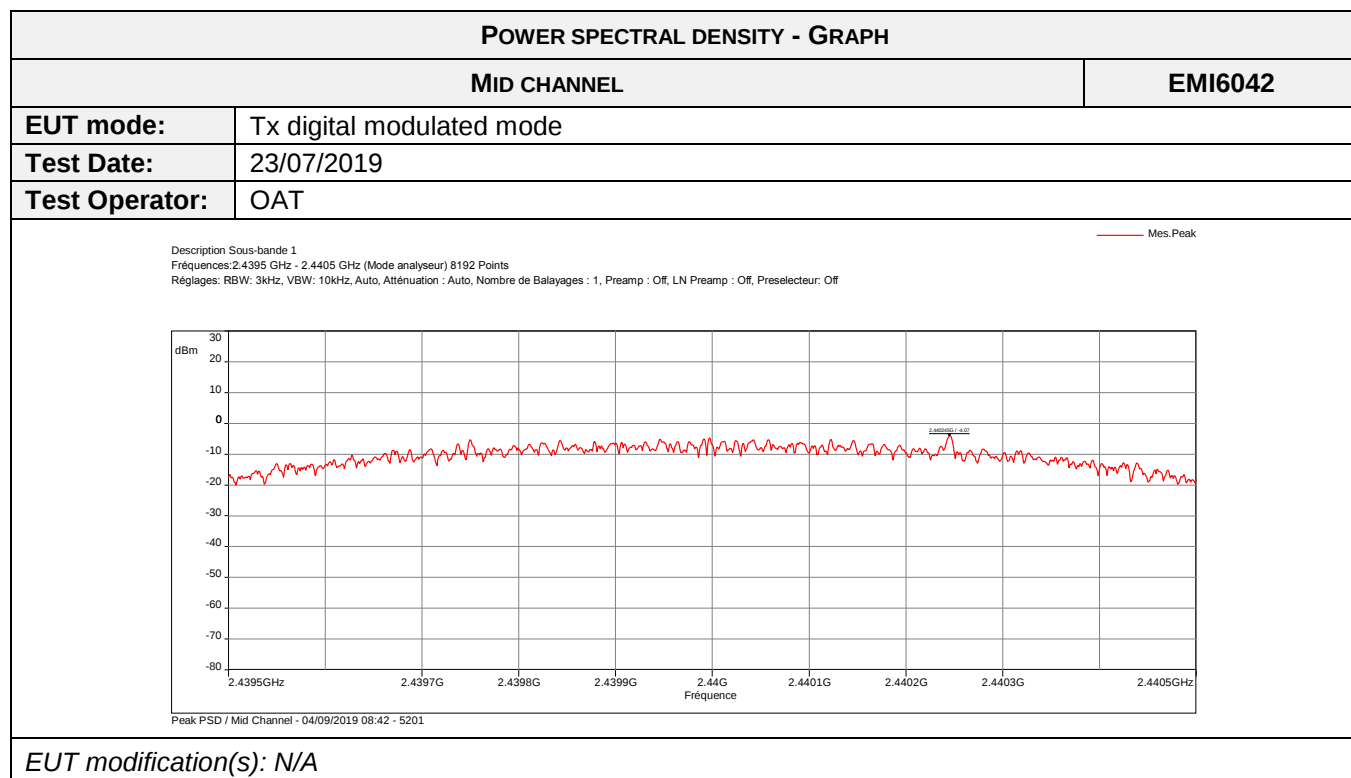
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	27.7 °C
Relative Humidity	20 to 75 %	55.8 %
Atmospheric pressure	N/A	1009 hPa
Test method deviation: N/A		
Supplementary information: EUT power supply is replaced by a stabilized power supply.		

CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412710124	16491	25/06/2019	25/08/2021
Cable	STORM MICROWAVE	N-1.5m	10263	29/10/2018	29/12/2020
Multimeter	Keithley	2010	6094	30/05/2019	30/07/2021
Power supply	TTi	PL303QMD	8496		
Spectrum analyzer	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Thermohygrometer	Testo	608-H1	7561	25/01/2019	25/03/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	25/01/2019	25/03/2021

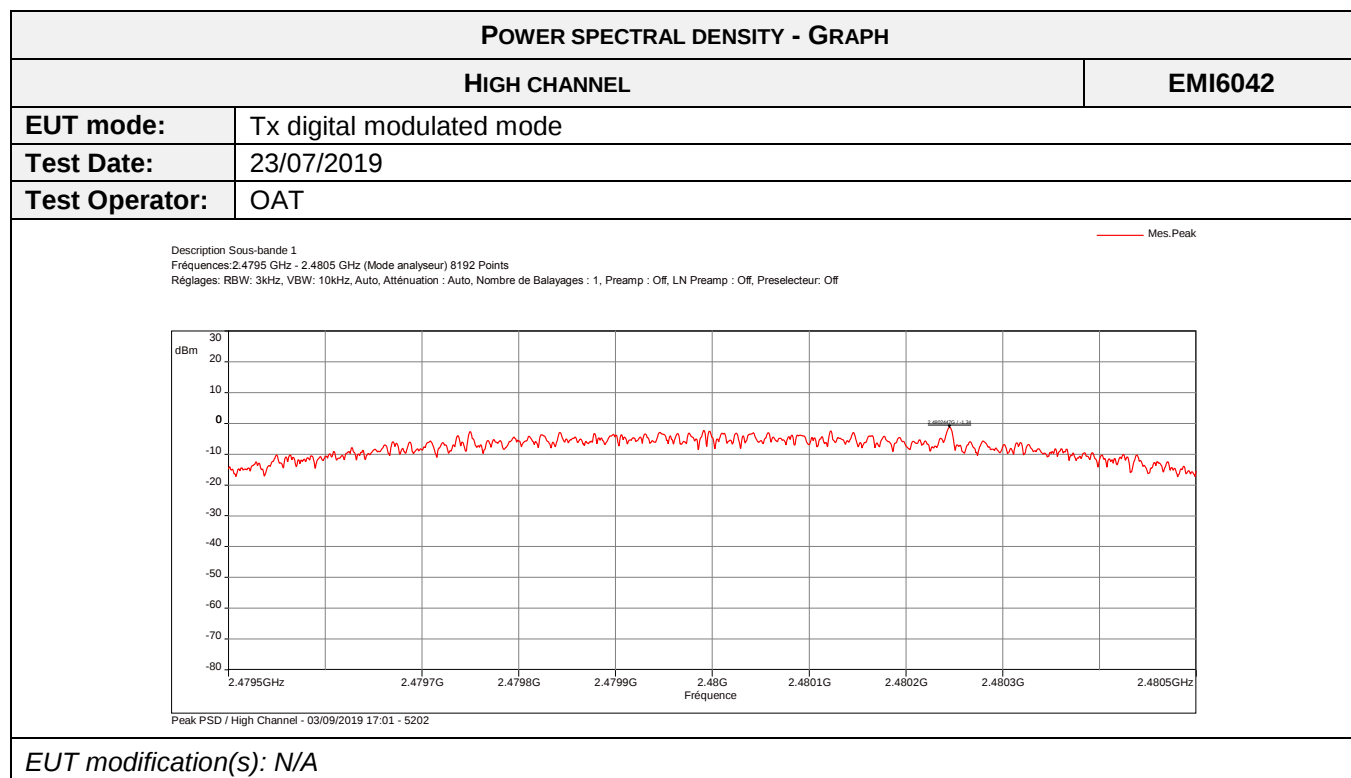
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POWER SPECTRAL DENSITY - TABULATED RESULTS			
LOW CHANNEL			EMI6042
U_{Start} (start of the test):	24Vdc	U_{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency		Level (dBm/3kHz)	Limit (dBm/3kHz)
2402.000 MHz		-4.33	8



POWER SPECTRAL DENSITY - TABULATED RESULTS			
MID CHANNEL			EMI6042
U_{Start} (start of the test):	24Vdc	U_{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency		Level (dBm/3kHz)	Limit (dBm/3kHz)
2440.000 MHz		-4.07	8



POWER SPECTRAL DENSITY - TABULATED RESULTS			
HIGH CHANNEL			EMI6042
U_{Start} (start of the test):	24Vdc	U_{End} (end of the test):	24Vdc
Voltage drop:	0%	Limit:	+/- 1%
Frequency		Level (dBm/3kHz)	Limit (dBm/3kHz)
2480.000 MHz		-1.34	8

8.9. Measurement of Frequency Stability §15.215 (C) And RSS-GEN

Reference standard:	FCC part 15 Radio part 15.215 c)
Test method:	FCC part 15 Radio part 15.215 c) and RSS Gen
Test description: The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. EUT is set inside the climatic enclosure. EUT is connected to the measuring receiver via 50Ω attenuator(s).	

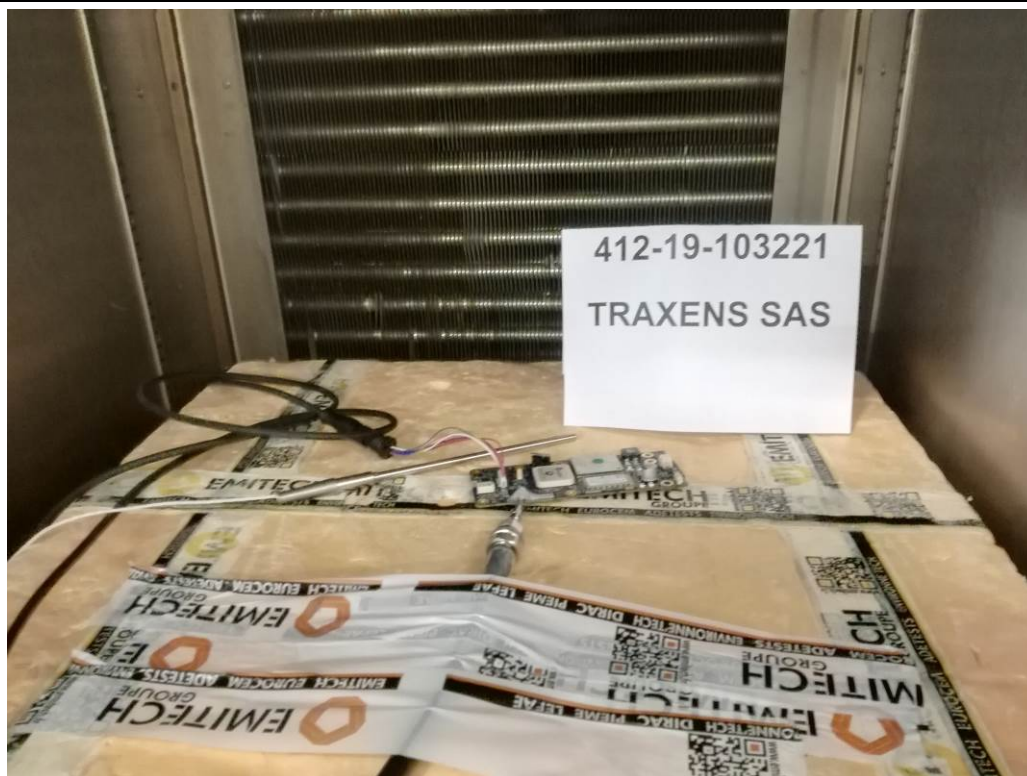
TEST CASE	EUT MODE	SEVERITY	RESULT TAB.	VERDICT
Low channel / 25°C	Tx CW	2400MHz <F< 2483.5MHz	EMI4560	PASS
Low channel / 85°C	Tx CW		EMI5183	PASS
Low channel / -40°C	Tx CW		EMI5184	PASS
High channel / 25°C	Tx CW		EMI5188	PASS
High channel / 85°C	Tx CW		EMI5193	PASS
High channel / -40°C	Tx CW		EMI5194	PASS

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	see tabulated results
Relative Humidity	20 to 75 %	see tabulated results
Atmospheric pressure	N/A	see tabulated results
Test method deviation: N/A		
Supplementary information: EUT power supply is replaced by a stabilized power supply.		

TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412720124	4391	01/02/2018	01/04/2020
Cable	N	3m	16428	04/05/2019	04/07/2021
Cable	Huber + Suhner	SF102K	16041	28/02/2019	28/04/2021
Climatic enclosure	Secasi	SM600C	1670		
Spectrum analyzer	Rohde & Schwarz	FSW43	14830	28/12/2018	28/02/2020
Thermometer contactless	GHM Greisinger	GMH 3710	12968	11/02/2019	11/04/2020

Blank cells = Permanent validity

TEST SETUP PHOTO(S)



FREQUENCY ERROR - TABULATED RESULTS			
TEST CASE	FREQUENCY	LIMIT	RESULT TAB.
Low channel / 25°C	2401.995640 MHz	2400MHz <F< 2483.5MHz	EMI4560
Low channel / 85°C	2402.027330 MHz	2400MHz <F< 2483.5MHz	EMI5183
Low channel / -40°C	2401.948160 MHz	2400MHz <F< 2483.5MHz	EMI5184
High channel / 25°C	2479.995460 MHz	2400MHz <F< 2483.5MHz	EMI5185
High channel / 85°C	2480.027010 MHz	2400MHz <F< 2483.5MHz	EMI5186
High channel / -40°C	2479.947990 MHz	2400MHz <F< 2483.5MHz	EMI5187

EUT MODIFICATIONS	OPERATOR	TEST DATE	RESULT TAB.
	OAT	23/07/2019	-

●●● End of test report ●●●