TÜVRheinland®	***Test Report nr.*** ***28113231-016***	ilac-MRA ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO **LAB N° 1356**

Test Report

47 CFR FCC Part 15 subpart C Par. 15.247
Intentional Radiators

Report reference no. ..... :	28113231-016
FCC Designation Number ..... :	IT0008
FCC Test Firm Registration # ..... :	804595
Tested by (name + signature)…….:	Andrea Bortolotti \ Tester
Approved by (name + signature)……:	Giovanni Molteni \ TM
Date of issue ..... :	14/01/2020
Total number of pages ..... :	40 Pages
Testing Laboratory ..... :	TÜV Rheinland Italia S.r.l.
Address ..... :	Via Mattei 3 - 20010 - Pogliano Milanese (MI) – Italy
Applicant's name ..... :	3M Company
Address ..... :	410 E. Fillmore Ave, St. Paul, MN, 55144-1000, USA
Test item description ..... :	Hearing protection and communication solution for high noise environments
Trade Mark ..... :	3M | PELTOR™
Manufacturer ..... :	3M
Model/Type reference ..... :	WS Series Peltor - MT15H7AWS6
Ratings ..... :	3Vdc (2x1,5Vdc type AA internna not rechargeable battery)
FCC ID ..... :	Y9ZMT15H7WS6
Sample ..... :	
Samples received on ..... :	11/03/2019
TUV reference samples ..... :	190212 (sampled by the customer)
Samples tested n. ..... :	1
Testing ..... :	
Start Date: ..... :	14/03/2019
End Date: ..... :	25/03/2019

SUMMARY

1. Release Control Record

Test report Number	Reason of change	Date of Issue
28113231-005	Original release	16/05/2019
28113231-008	Correct model name, added derived models table. This version cancel and replaces full test report nr.28113231-005 issue date 16/05/2019 and its previous versions	24/05/2019
28113231-012	Editorial change This version cancel and replaces full test report nr.28113231-008 issue date 16/05/2019 and its previous versions	18/11/2019
28113231-015	Editorial change This version cancel and replaces full test report nr.28113231-012 issue date 18/11/2019 and its previous versions	29/11/2019
28113231-016	Retesting Average time of occupancy This version cancel and replaces full test report nr.28113231-015 issue date 29/11/2019 and its previous versions	14/01/2020

2. Reference Standards

Standard	Description
FCC Part 15 (Subpart C)	§15.247 Operation within the bands 902-928 MHz, 2400-2483,5 MHz, and 5725-5850 MHz.
FCC Part 15 (Subpart C)	§15.207 Conducted Limits
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna Requirement
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices

3. Summary of testing

§ 15.203 § 15.247 (b)(4)(i)	Antenna Requirements	PASS
§ 15.207 (a)	Power Line Conducted Emission	Not performed
§ 15.209 (a) (f)	Radiated Emission	Not performed
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	Not performed
§ 15.247 (d)	Out-of-band emissions	PASS
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	PASS
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	PASS
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	PASS
§ 15.247(a)(1)(iii)	Time occupancy (Dwell Time) of Each Ch. within a 0,4 x Nch (sec) Period	PASS
§ 15.247(a)(2)	6dB Minimum Bandwidth	PASS
§ 15.247(b)	Maximum Peak Output Power	
§ 15.247(b) (1)	Peak Output Power (conducted)	PASS
§ 15.247(b) (3)	RF power output (conducted)	N.A.[1]
§ 15.247(b) (4)	Antenna gain	
§ 15.247I	Operation with directional antenna gains greater than 6 dBi	PASS
§ 15.247 I	Power Spectral Density	N.A.[1]
§ 15.247 (f)	Hybrid systems	N.A.[1]
§ 15.247 (g)	FHSS Transmission characteristics	PASS
§ 15.247 (h)	Recognition of occupied channel and multiple transmission system	N.A
§ 15.247(i) (§ 47CFR 1.1307(b)(1))	RF humane exposure	PASS

Note 1	Not applicable for DSS equipment

Possible test case verdicts:

- test case does not apply to the test object ....:	N/A
- test object does meet the requirement .....:	PASS
- test object does not meet the requirement ....:	FAIL

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

1. General product information

Description: Hearing protection and communication solution for high noise environments

Model: WS Series Peltor - MT15H7AWS6

Ratings: 3Vdc (2xAA or Rechargeable NiMH Pack)

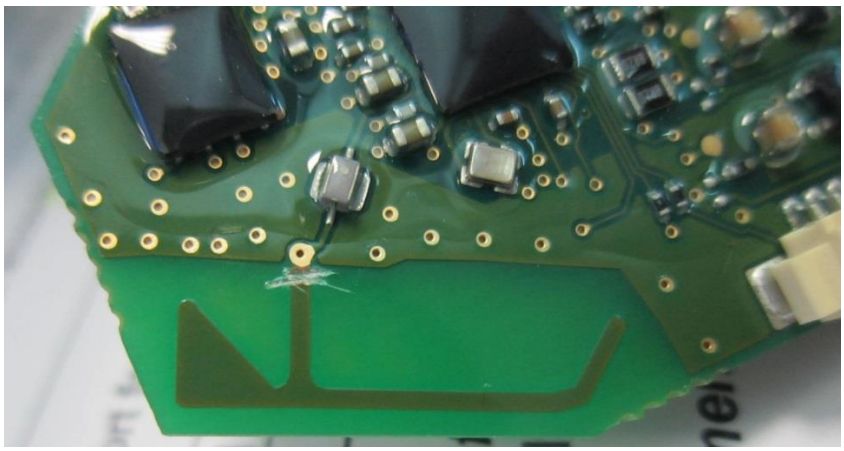
2. General Chipset information

Qualcomm CSR8670

CSR8670 Specifications

Bluetooth	Integrated dual-mode radio and balun (50 Ω) -90dBm receiver sensitivity; +10dBm transmitter Bluetooth v4.2 firmware Support for various profiles including: HFP 1.6, A2DP 1.3.1, AVRCP 1.6, HOGP 1.0, FMP 1.0, PXP 1.0, BAS 1.0, TPS 1.1
MCU	80MHz programmable RISC processor
Audio	Programmable 24-bit fixed-point 80MHz Kalimba DSP 2x single-cycle MACs; 24x24-bit multiply & 56-bit accumulator
Battery Support & Power Management	Li-Ion battery charger supporting up to 200mA 2x high-efficiency switch-mode regulators with 1.8V and 1.35V outputs from battery supply
Audio Interfaces	Stereo 16-bit ADC; up to 48kHz sampling frequency Stereo 16-bit DAC; up to 96kHz sampling frequency Microphone inputs: up to 2x analog & 6x digital (MEMS)
Physical Interfaces	2x PCM/I²S & 1x SPDIF with 24-bit support Up to 29x PIOs, including 14x GPIOs, USB2.0, I²C, SPI, UART 3x LED controllers; support for up to 6x touch sensor inputs
Memory	Integrated 16Mb programmable flash memory with support for up to 64Mb external SPI FLASH 56kB system MCU RAM 64k x 24-bit data & 12k x 32bits program memory for DSP
Packaging	6.5 x 6.5 x 1mm, 0.5mm pitch 112-ball VFBGA or 4.73 x 4.84 x 0.6mm, 0.5mm pitch 79-ball WLCSP

3. General Antenna information



As declared by the manufacturer: antenna gain +6.55dBi

4. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Hearing protection and communication solution for high noise environments	3M	WS Series Peltor - MT15H7AWS6	---

Note:

* Use :

EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

No other Auxiliary/Associated Equipment was connected/installed on the EUT

5. Input/Output Ports

CONNECTIONS

Port		Description	Connection	Cable lenght
1	Enclosure	Non conductive surface	Closed by pressure	---
2	AC Power Port	AC Input	Port not present	---
3	DC Power Port	DC Input	Internal battery powered	---
4	I/O	Universal inputs/outputs	Port not present	---

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
WN = Wired Network

6. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	3Vdc	---	---	---	---	---

7. Derived model(s)

Article no.	Article description	Attachment	Connection to ext radio
MT15H7AWS6	WS PROTAC XPI HEADBAND	Headband	No
MT15H7AWS6-111	WS PROTAC XPI	Headband	Yes
MT15H7BWS6-111	WS PROTAC XPI, FLEX CON, W B-band	Neckband	Yes
MT15H7P3EWS6	WS6 PROTAC XPI, HELMET ATTACHMENT	Helmet	No
MT15H7P3EWS6-111	WS6 PROTAC XPI W HELMET ATT.	Helmet	Yes

8. EUT Operation Modes

Operation mode	Description
#1	Continuous Bluetooth Modulation RF Transmission RF setting during tests: Frequency: 2402 MHz (low channel); 2441 MHz (mid channel); 2480 MHz (high channel); π/4-DQPSK modulation (worst case configurable by Bluetest testing software)
#2	Continuous Bluetooth Modulation RF Transmission RF setting during tests: Frequency hopping; π/4-DQPSK modulation (worst case configurable by Bluetest testing software); ACL frame type DH5

Frequency (Transmission)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**2402 MHz**	2	2403 MHz	3	2404MHz	4	2405 MHz
5	2406 MHz	6	2407 MHz	7	2408 MHz	8	2409 MHz
9	2410 MHz	10	2411 MHz	11	2412 MHz	12	2413 MHz
13	2414 MHz	14	2415 MHz	15	2416 MHz	16	2417 MHz
17	2418 MHz	18	2419 MHz	19	2420 MHz	20	2421 MHz
21	2422 MHz	22	2423 MHz	23	2424 MHz	24	2425 MHz
25	2426 MHz	26	2427 MHz	27	2428 MHz	28	2429 MHz
29	2430 MHz	30	2431 MHz	31	2432 MHz	32	2433 MHz
33	2434 MHz	34	2435 MHz	35	2436 MHz	36	2437 MHz
37	2438 MHz	38	2439 MHz	39	2440 MHz	**40**	**2441 MHz**
41	2442 MHz	42	2443 MHz	43	2444 MHz	44	2445 MHz
45	2446 MHz	46	2447 MHz	47	2448 MHz	48	2449 MHz
49	2450 MHz	50	2451 MHz	51	2452 MHz	52	2453 MHz
53	2454 MHz	54	2455 MHz	55	2456 MHz	56	2457 MHz
57	2458 MHz	58	2459 MHz	59	2460 MHz	60	2461 MHz
61	2462 MHz	62	2463 MHz	63	2464 MHz	64	2465 MHz
65	2466 MHz	66	2467 MHz	67	2468 MHz	68	2469 MHz
69	2470 MHz	70	2471 MHz	71	2472 MHz	72	2473 MHz
73	2474 MHz	74	2475 MHz	75	2476 MHz	76	2477 MHz
77	2478 MHz	78	2479 MHz	**79**	**2480 MHz**		

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBµV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBµV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

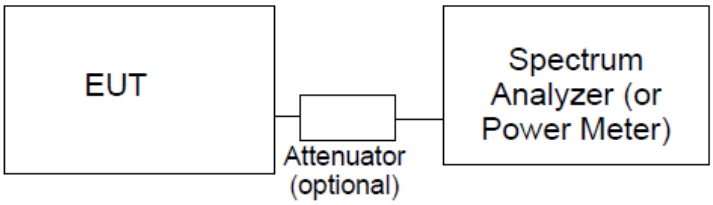
25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

12. Test Conditions and Results

TEST: Antenna requirements			**PASS**
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	56%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	3 Vdc	Enclosure	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.203 § 15.247 (B)(4)(I)		

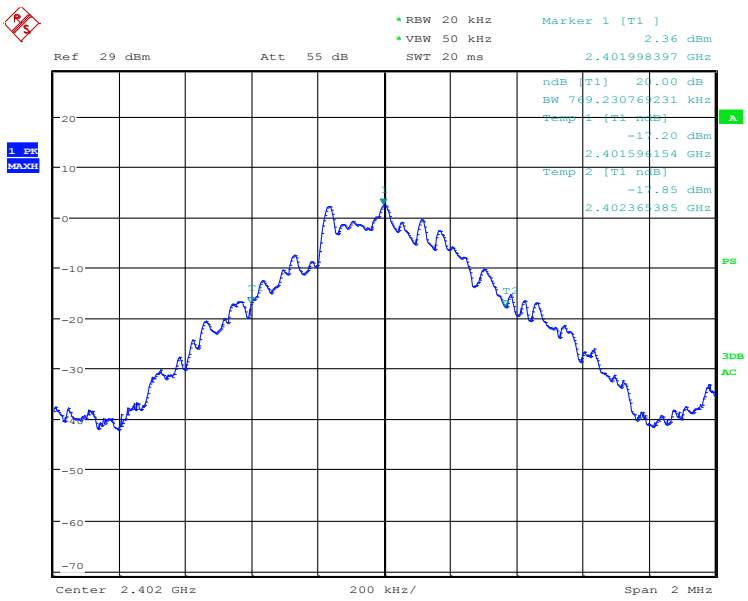
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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	---
Antenna type	Internal PCB antenna
Maximum total gain	As delcared by the manufacturer, antenna gain +6,55dBi
External power amplifiers	Not present

TEST: 20dB Bandwidth			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	48%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	SMA Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (A)(1)		
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

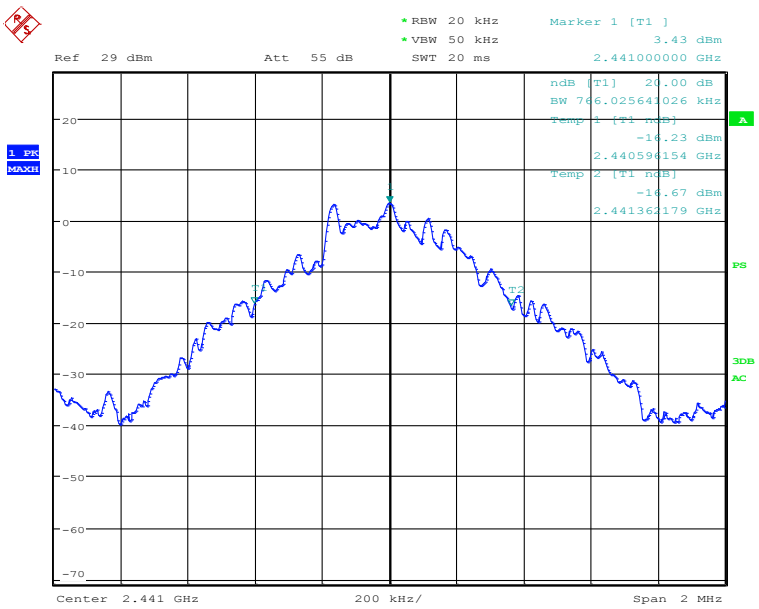
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Low Channel (2402 MHz)
Plot n°1



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Plot (No.)
Low	2402	769.23	1

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	2401.59MHz	Fmax	2402.36 MHz

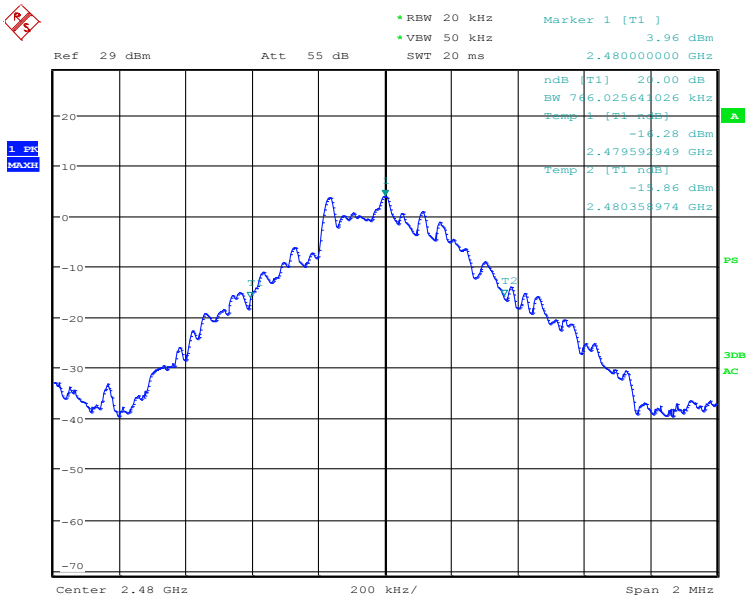
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Middle Channel (2441 MHz)
Plot n°2



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Plot (No.)
Middle	2441	766.03	2

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	2440.59MHz	Fmax	2441.36MHz

Graphical representation of 20dB Bandwidth
Operation Mode: #1 – High Channel (2480 MHz)
Plot n°3



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Plot (No.)
High	2480	766.02	3

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	2479.59MHz	Fmax	2480.35MHz

TEST: RF power output, radiated (EIRP)		**PASS**
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22,5°C
	Relative Humidity (%)	51%
	Air pressure (hPa)	1020
—	Frequency	Application Point
Fully configured sample tested at the power line frequency	3Vdc	SMA Connector
Equipment mode:	Operation mode	#1
FCC Standard	§15.247 (B) (2)	

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

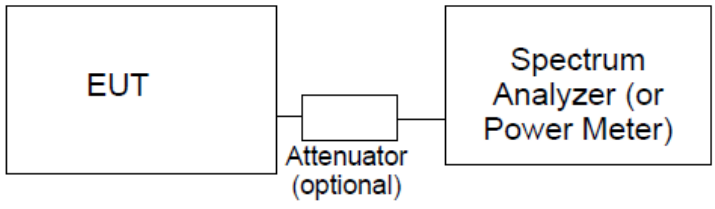
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

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

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

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

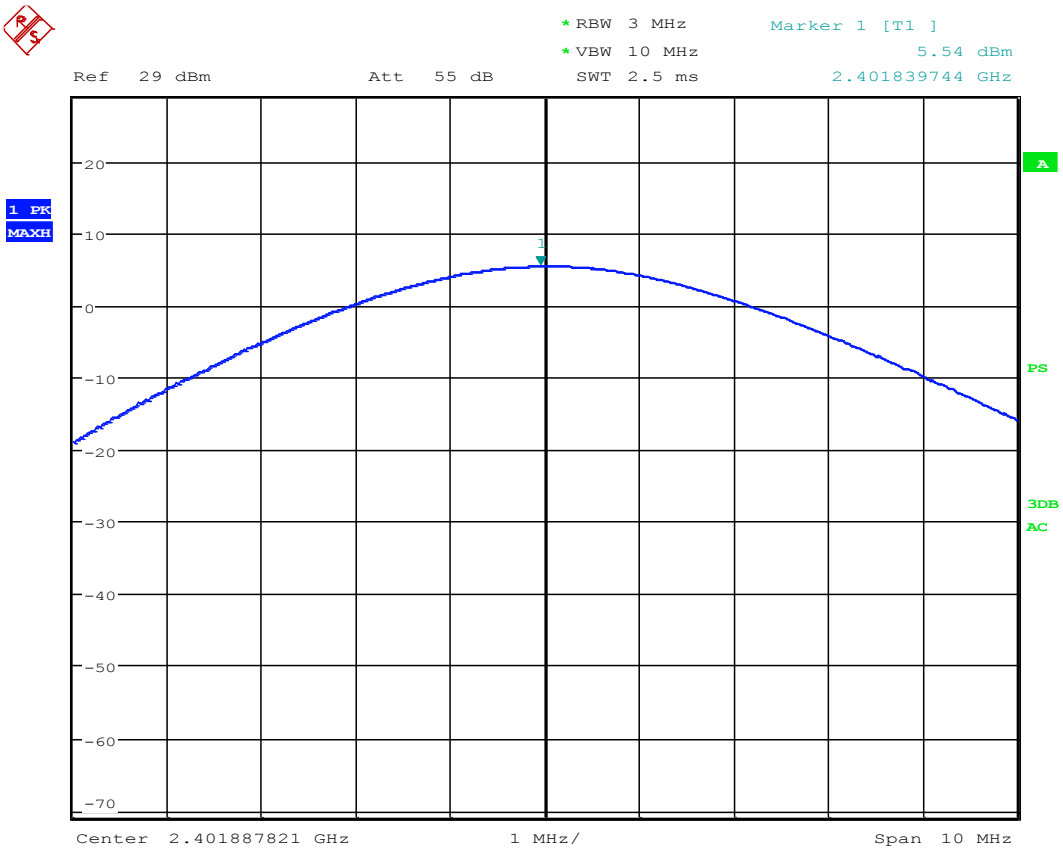
Further information to test setup



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

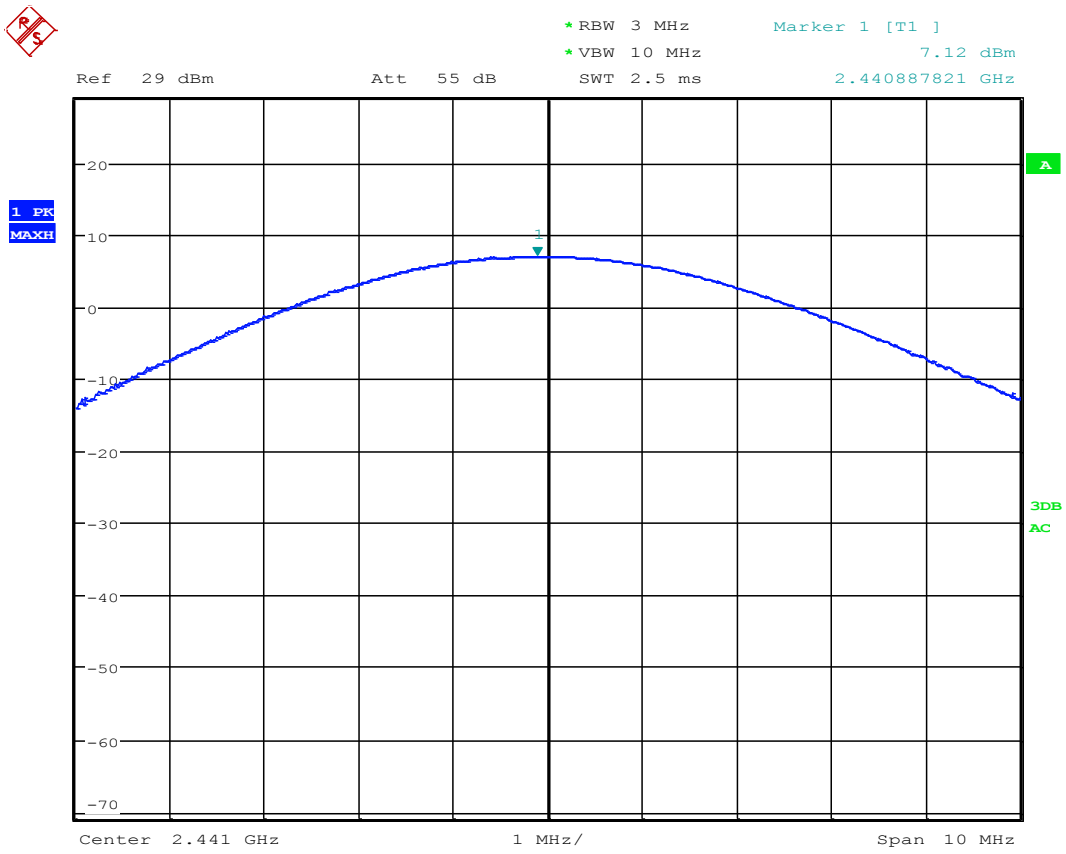
Graphical representation of RF power output

Low Channel (2402 MHz)



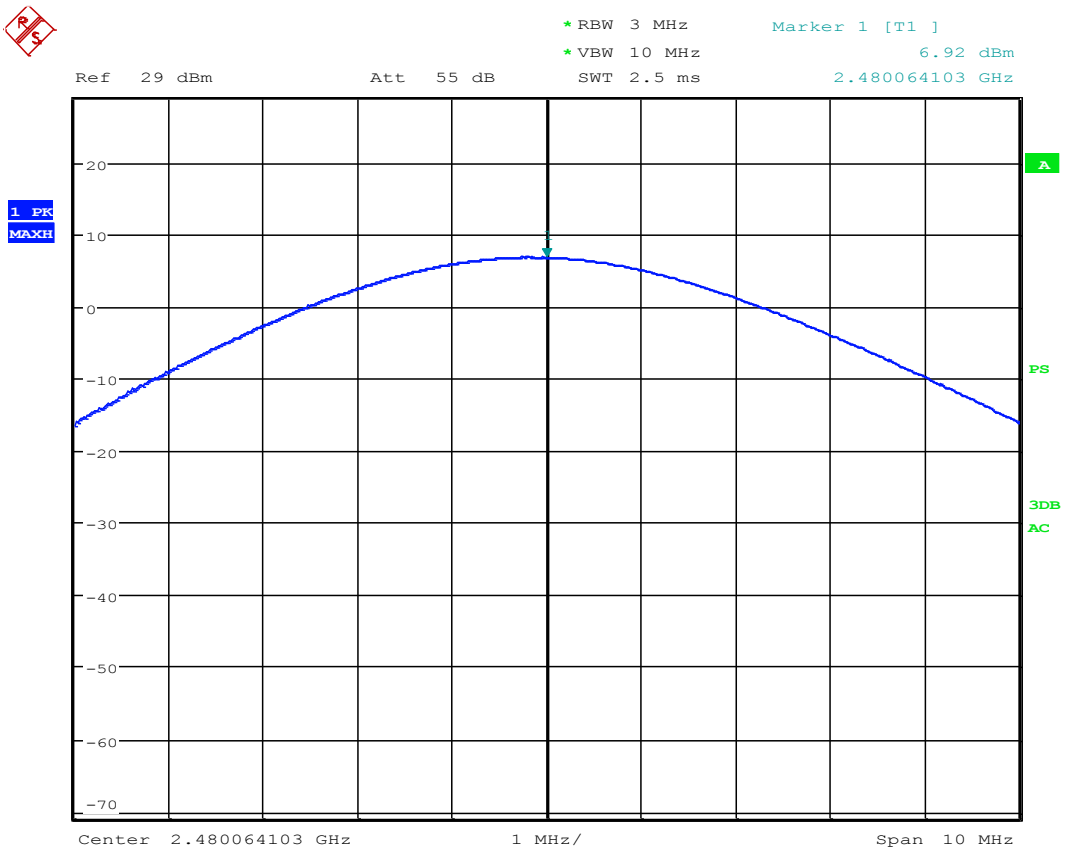
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
Low	2402	5,54	3,56	29.45

Graphical representation of RF power output
Med Channel (2441 MHz)



Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
Med	2441	7.12	5.15	29.45

Graphical representation of RF power output
High Channel (2480 MHz)

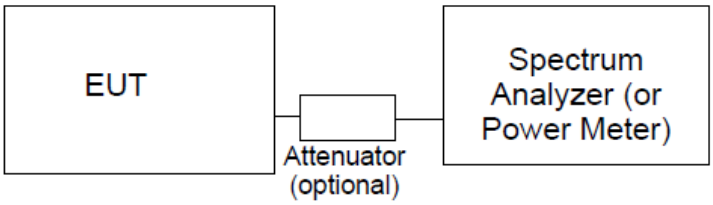


Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
High	2480	6,92	4,92	29.45

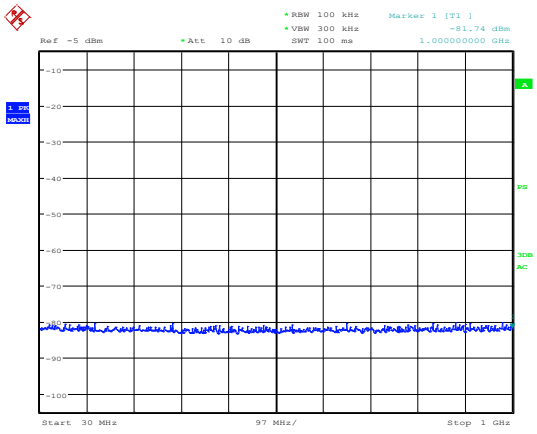
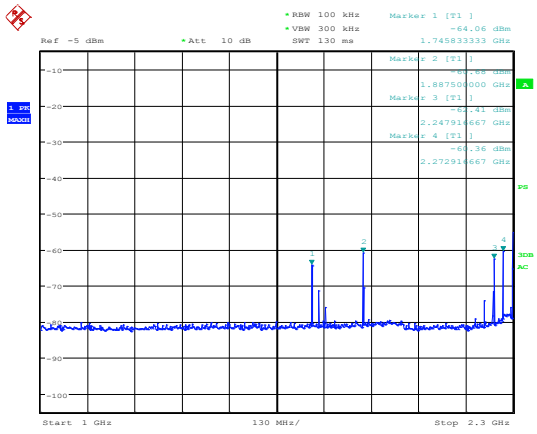
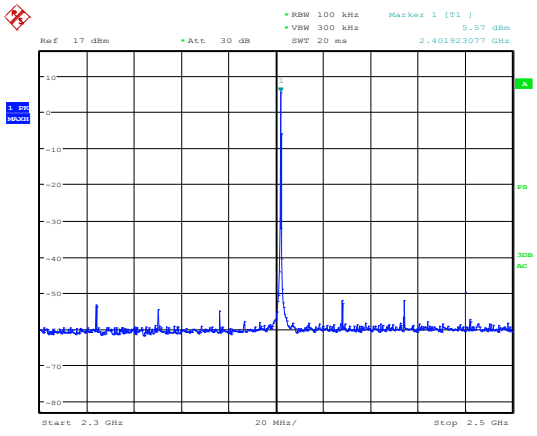
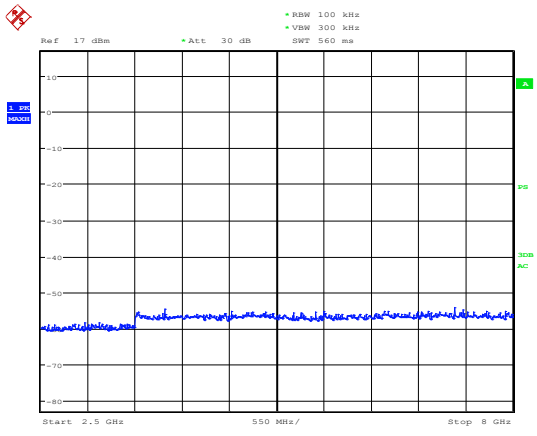
TEST: Out-of-band emissions			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C	
	Relative Humidity (%)	50%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	SMA Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (D)		

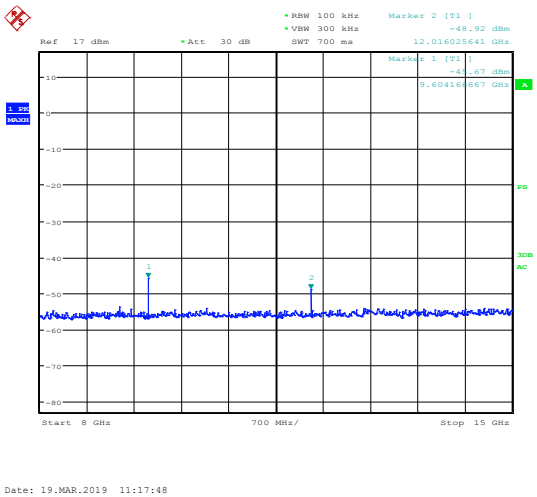
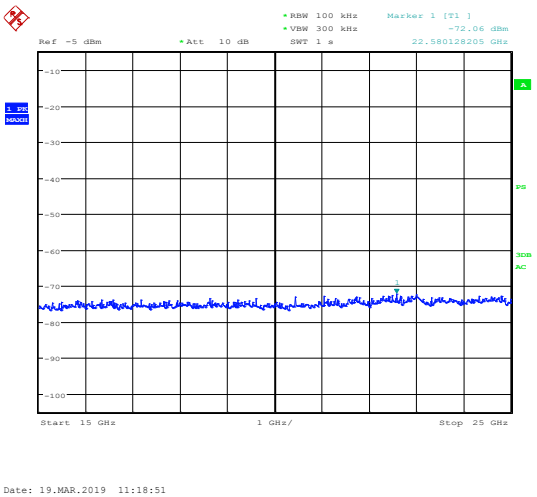
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

Further information to test setup

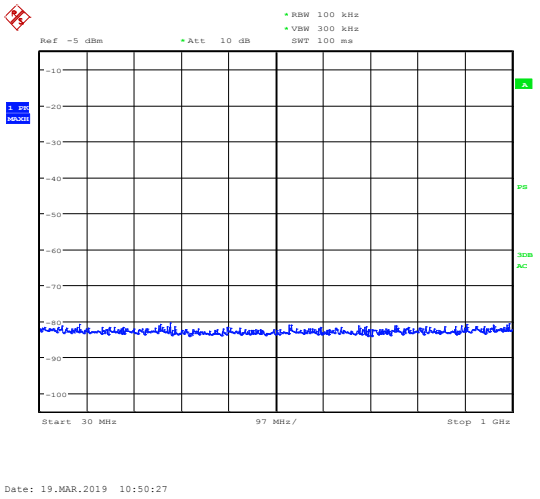
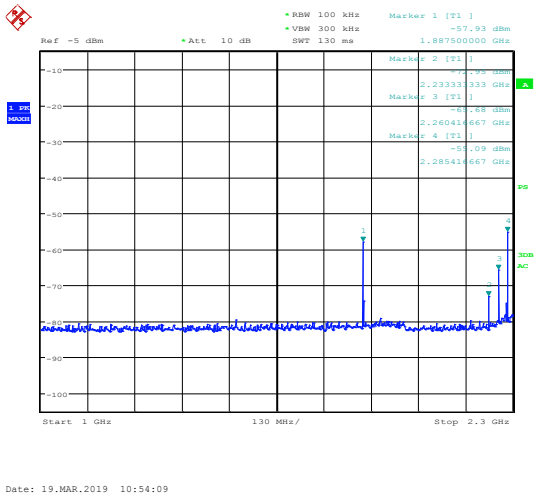
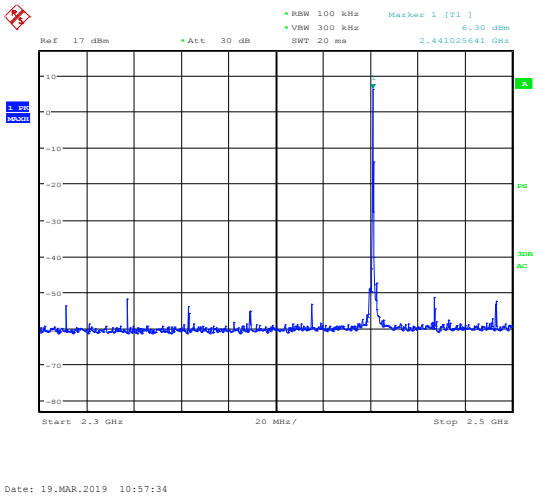
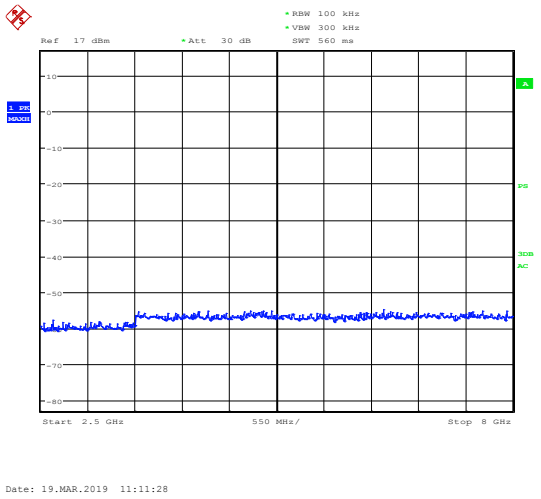


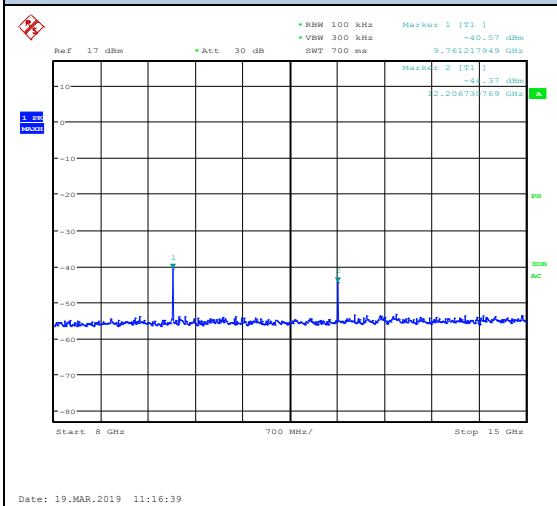
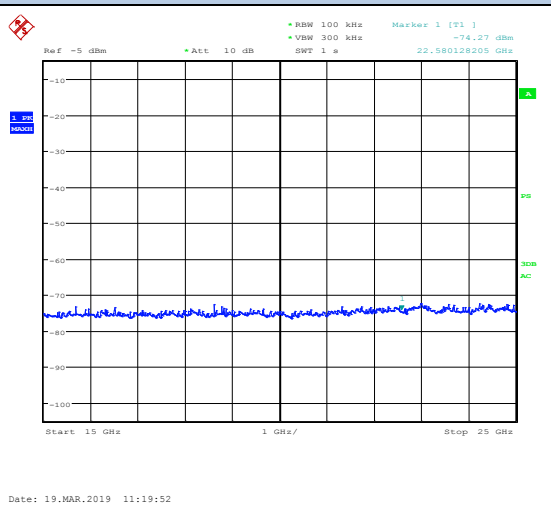
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019
Highpass Filter	Wainwright Instr.	Wainwright Instr.	WHKX10-2520-2800-18000-40ss	87020799	05/2018

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – Low Channel (2402 MHz)	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 2,3GHz
	
Frequency: 2,3GHz – 2,5GHz	Frequency: 2,5GHz – 8GHz
	

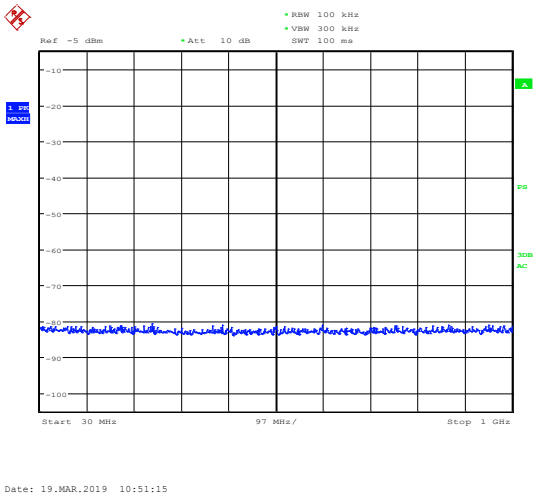
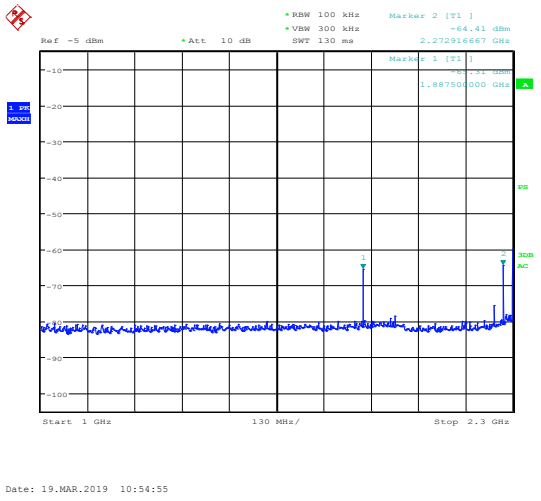
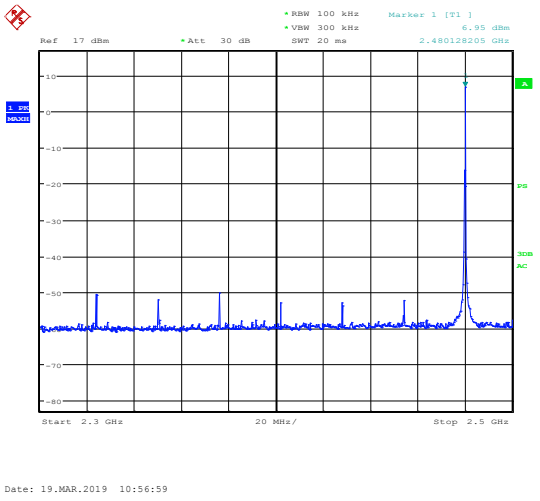
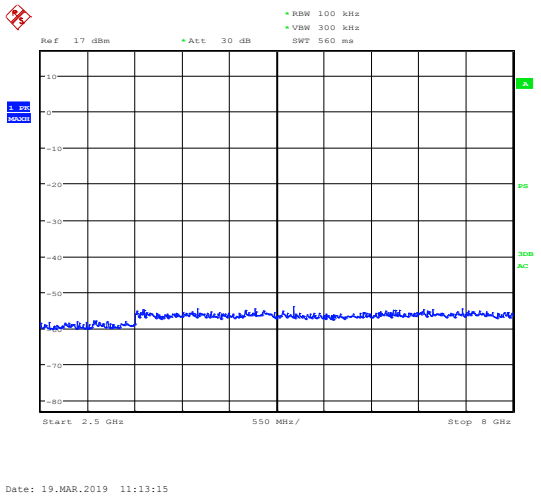
Frequency: 8GHz – 15GHz	Frequency: 15GHz – 25GHz
	

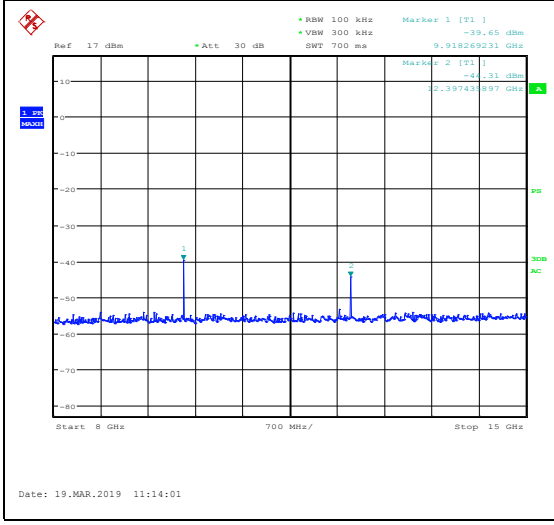
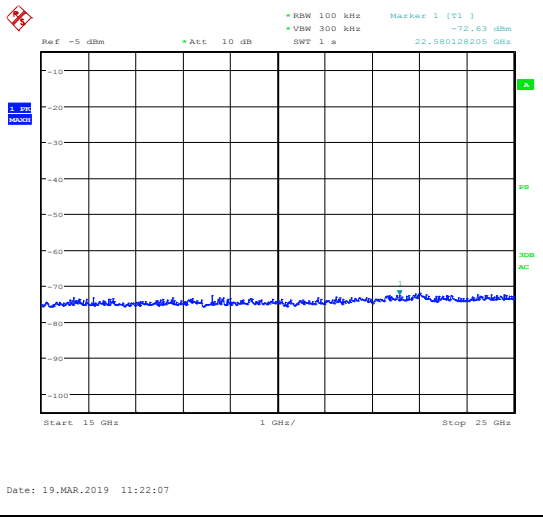
Frequency (MHz)	Level (dBm)	Fundamental Level (dBm)	Difference (dB)	Limit (at least) (dB)
9604,16	-45,67	5,57	51,24	20
12016,02	-48,92		54,49	

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – Mid Channel (2441 MHz)	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 2,3GHz
	
Frequency: 2,3GHz – 2,5GHz	Frequency: 2,5GHz – 8GHz
	

Frequency: 8GHz – 15GHz	Frequency: 15GHz – 25GHz
	

Frequency (MHz)	Level (dBm)	Fundamental Level (dBm)	Difference (dB)	Limit (at least) (dB)
9761,22	-40,57	6,30	46,87	20
12206,73	-44,37		50,67	

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – High Channel (2480 MHz)	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 2,3GHz
	
Frequency: 2,3GHz – 2,5GHz	Frequency: 2,5GHz – 8GHz
	

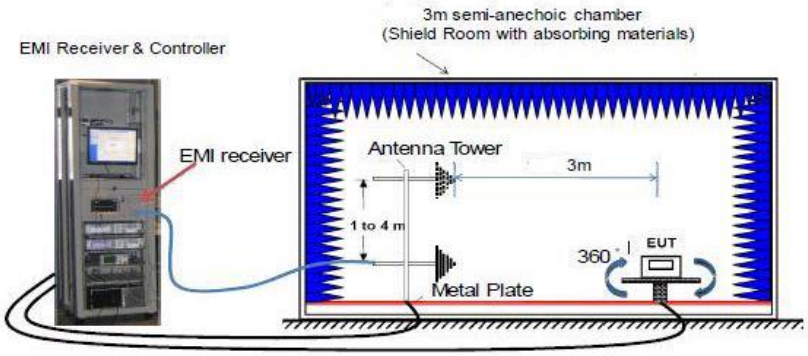
Frequency: 8GHz – 15GHz	Frequency: 15GHz – 25GHz
	

Frequency (MHz)	Level (dBm)	Fundamental Level (dBm)	Difference (dB)	Limit (at least) (dB)
9918,26	-39,65	6,95	46,60	20
12397,44	-44,31		51,26	

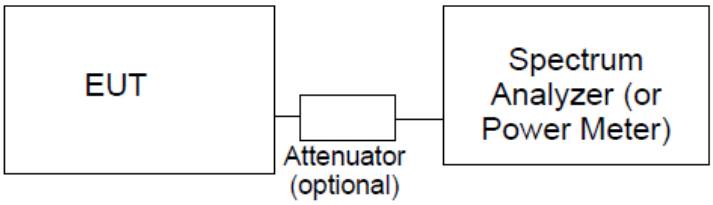
TEST: 100 kHz Bandwidth of Frequency Band Edges			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	52%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	SMA Connector Enclosure	
Equipment mode:	Operation mode	#1; #2	
FCC Standard	§15.247 (D)		

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

Further information to test setup (Radiated)



Further information to test setup (conducted)

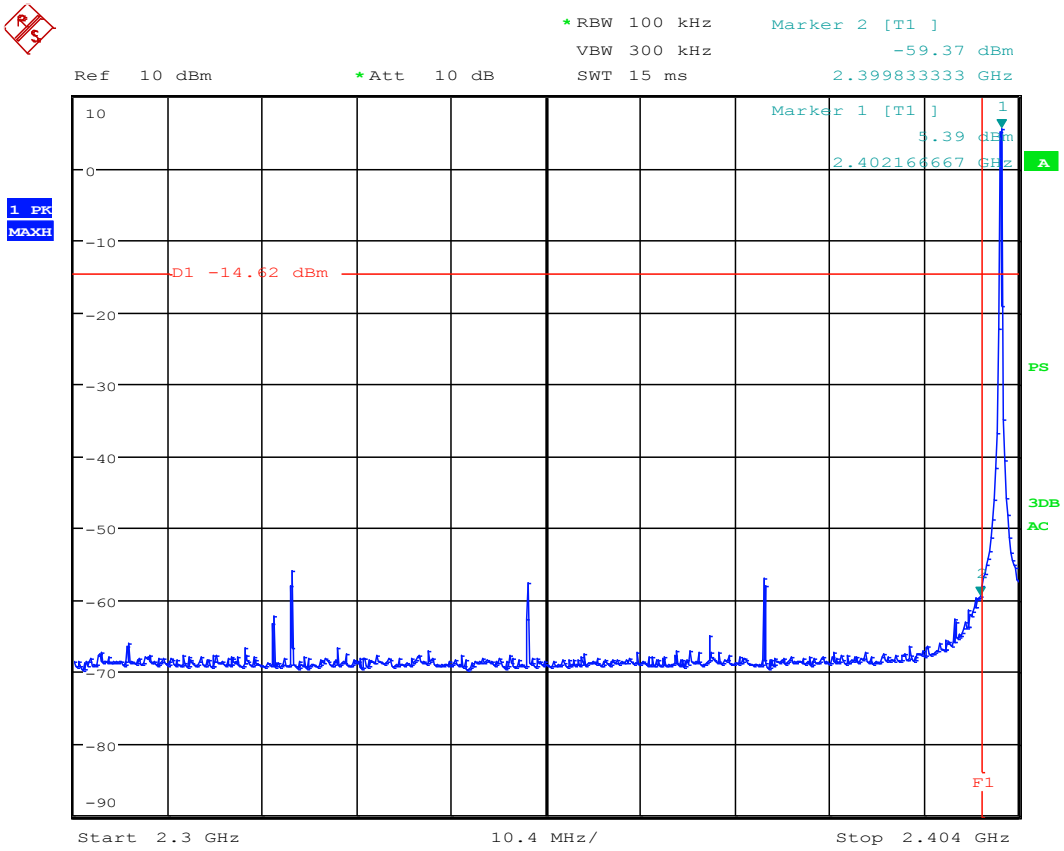


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted

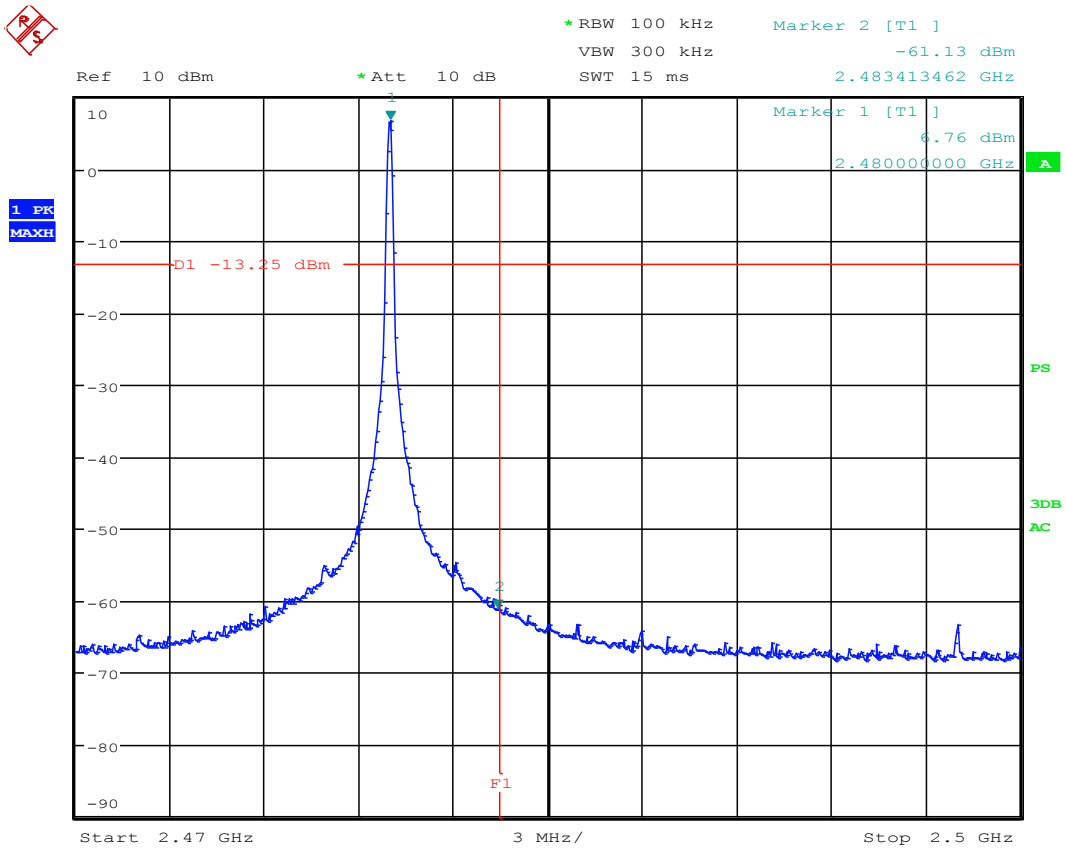
Operation Mode: #1 – Low Channel (2402 MHz)

Plot n°1



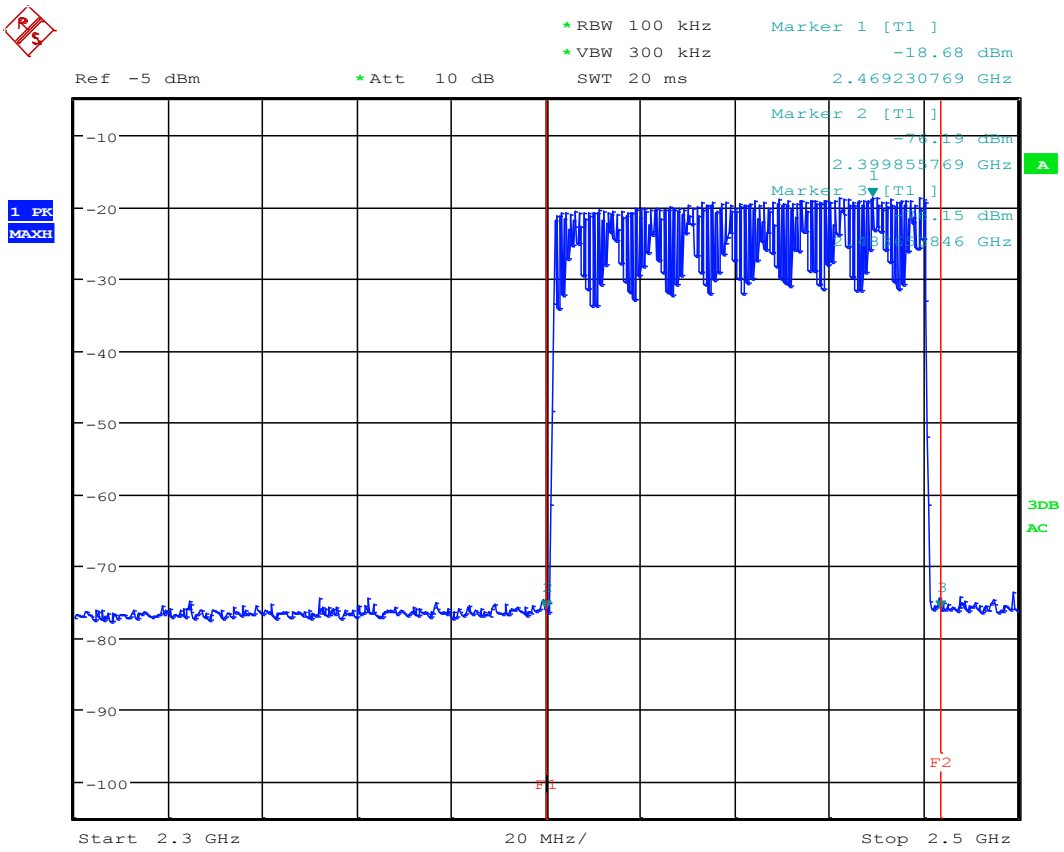
Frequency (MHz)	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2400	**-59,37**	**5,39**	**64,76**	**-14,62**	**44,75**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – High Channel (2480 MHz)

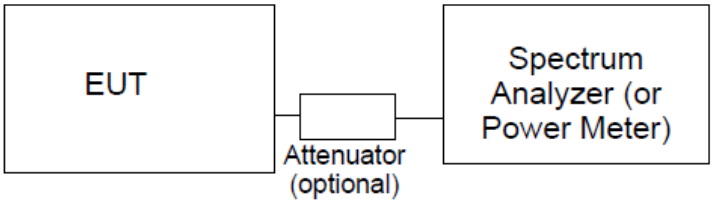


Frequency (MHz)	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2483,41	**-61,13**	**6,76**	**67,89**	**-13,24**	**47,89**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Hopping mode (Op.condition #2)

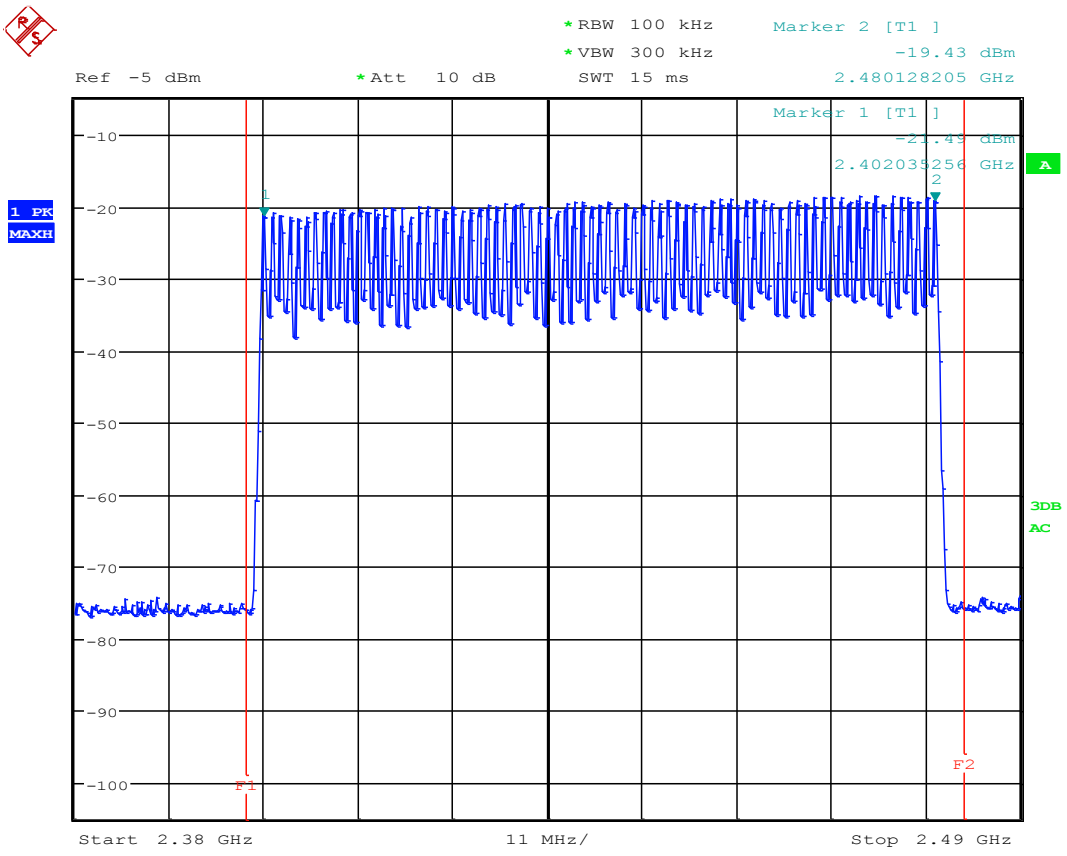


Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2400,00	**-76,19**	**-18,68**	**57,51**	**-38,68**	**37,51**
2483,50	**-76,15**	**-18,68**	**57,47**	**-38,68**	**37,47**

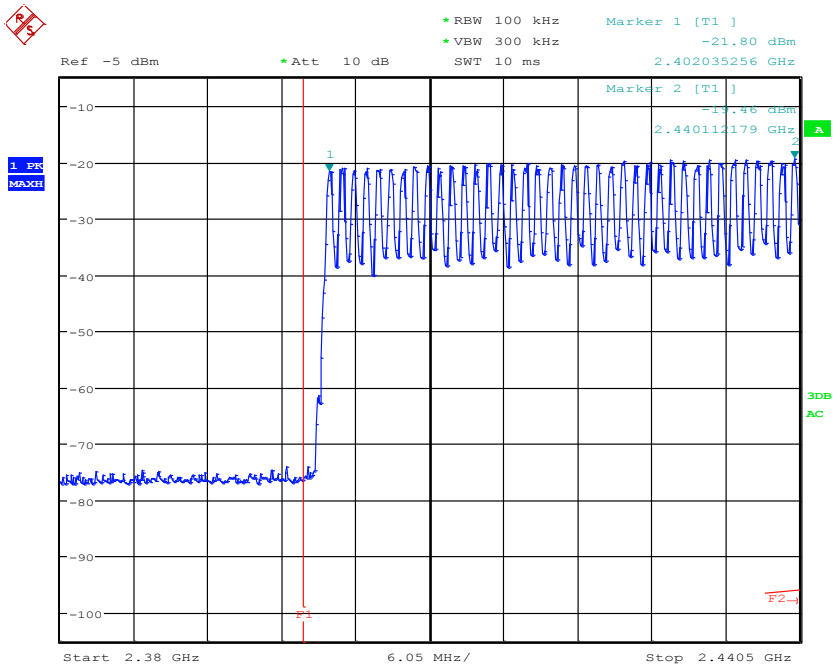
TEST: Number of Hopping frequencies		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C
	Relative Humidity (%)	36%
	Air pressure (hPa)	1033
—	Power Supply & Frequency	Application Point
Fully configured sample tested at the power line frequency	3Vdc	Sma connector
Equipment mode:	Operation mode	#2
FCC Standard	§15.247 (A) (1) (III)	
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.		
Further information to test setup		

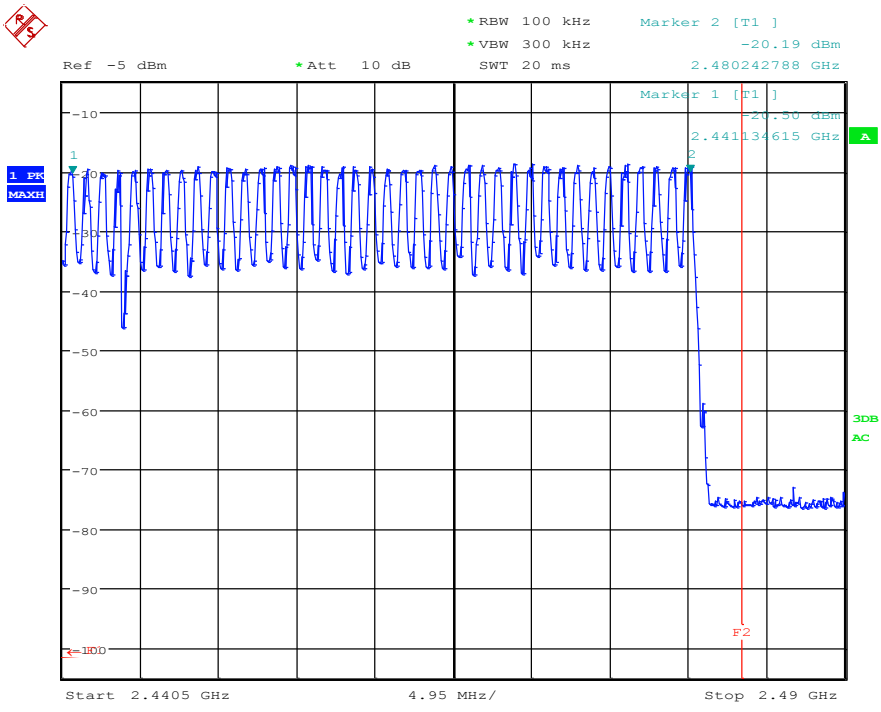
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

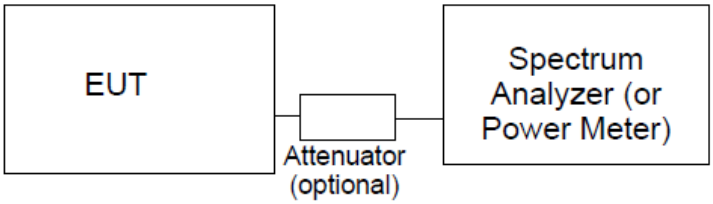
Graphical rapresentation
Operation Mode: #1
Number of Hopping Frequencies: 79



Graphical rapresentation
Operation Mode: #1
Number of Hopping Frequencies: 79

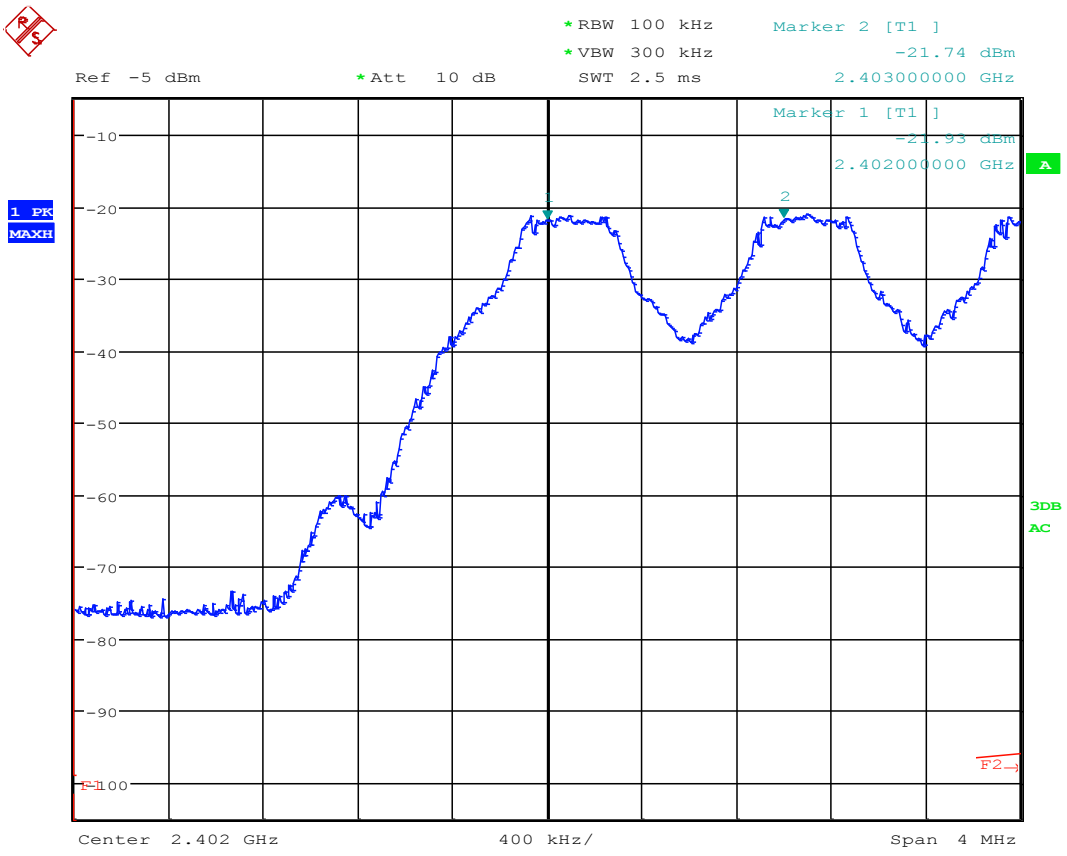




TEST: Carrier frequency separation		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	23°C
	Relative Humidity (%)	36%
	Air pressure (hPa)	1033
—	Power Supply & Frequency	Application Point
Fully configured sample tested at the power line frequency	3Vdc	Sma connector
Equipment mode:	Operation mode	#2
FCC Standard	§15.247 (A) (1)	
FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.		
Further information to test setup		

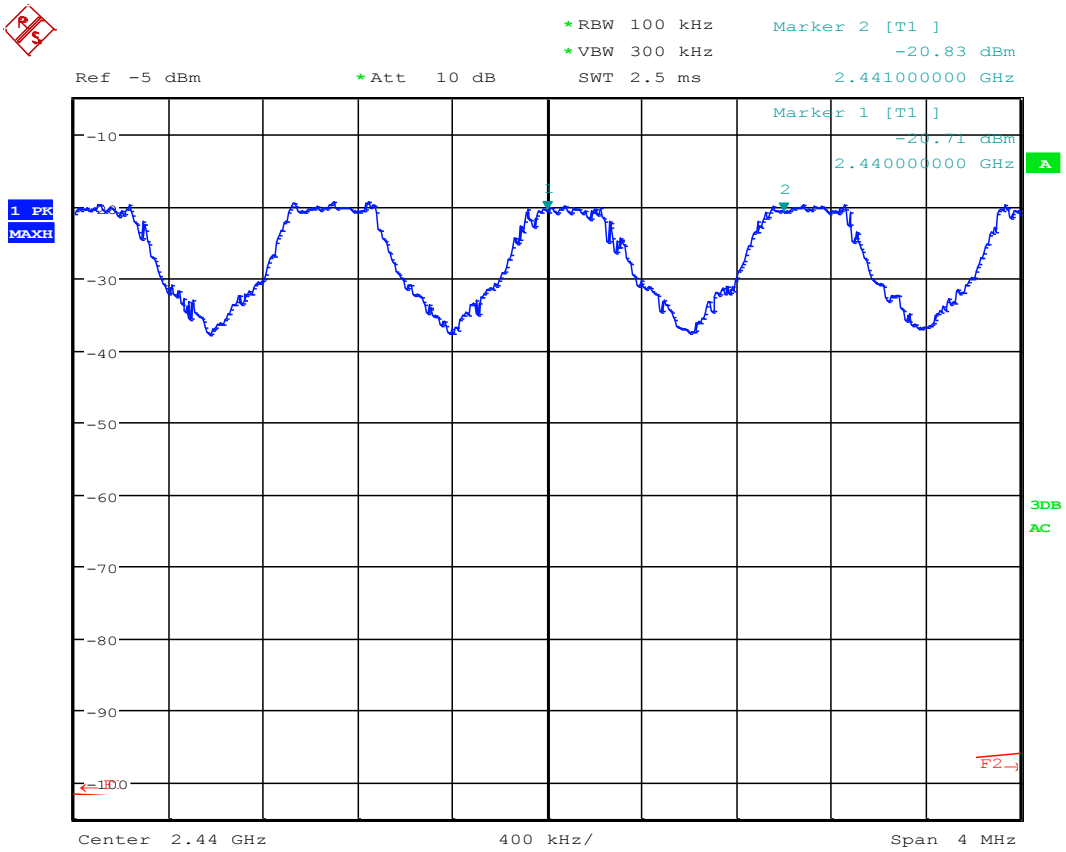
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of carrier frequency separation
Operation Mode: #1
Plot n°1



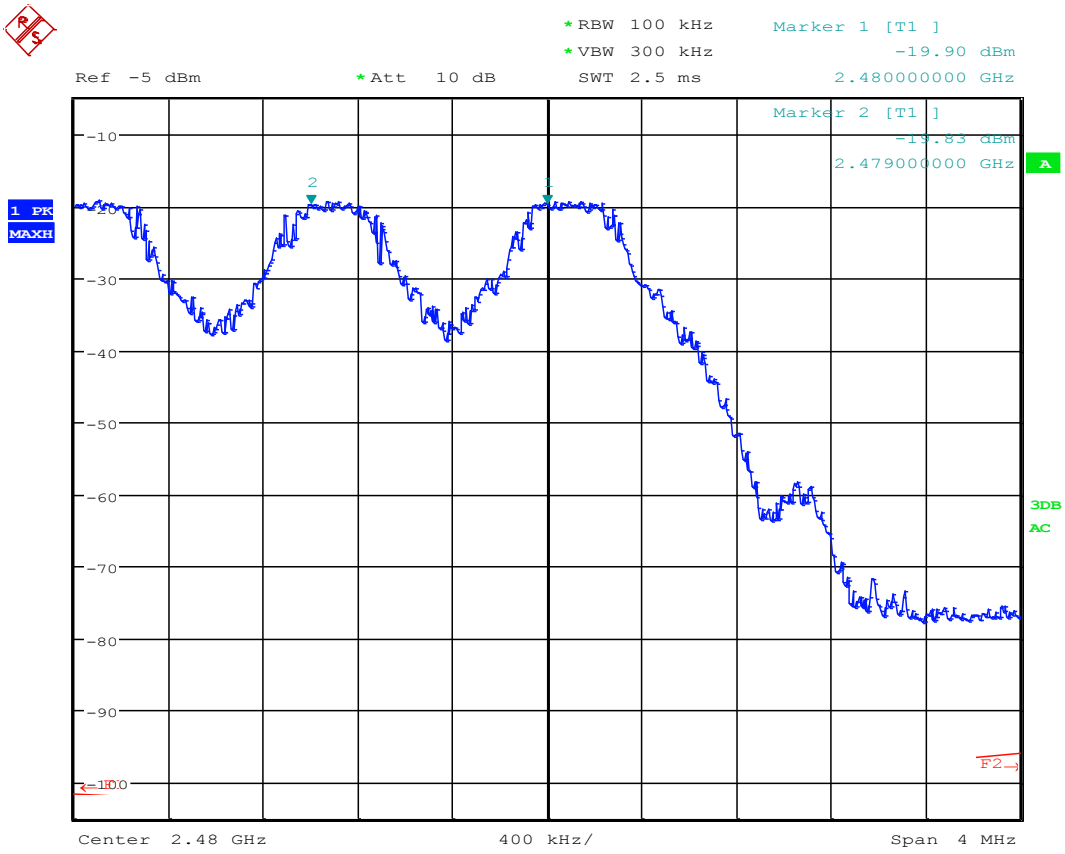
Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
1-2 (Low)	1000	≥769.23	1

Graphical representation of carrier frequency separation
Operation Mode: #1
Plot n°2

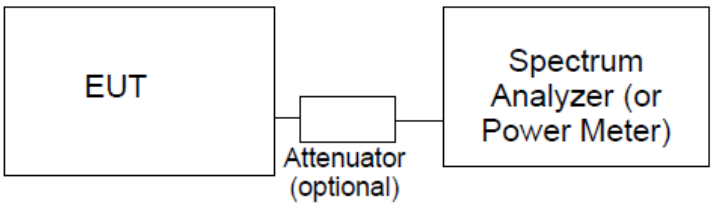


Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
39-40 (Middle)	1000	≥766.03	2

Graphical representation of carrier frequency separation
Operation Mode: #1
Plot n°3



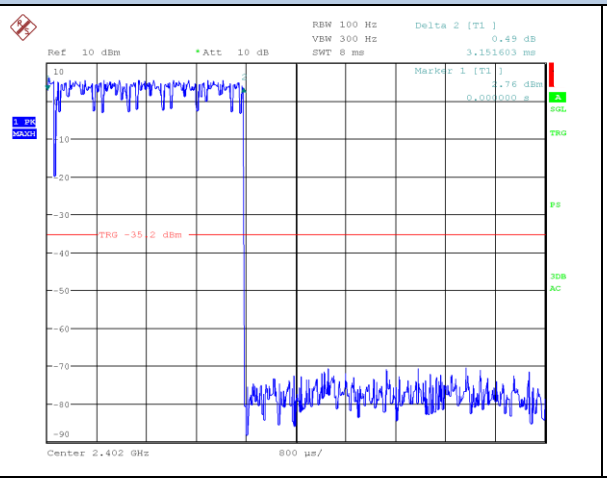
Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
78-79 (High)	1000	≥766.02	3

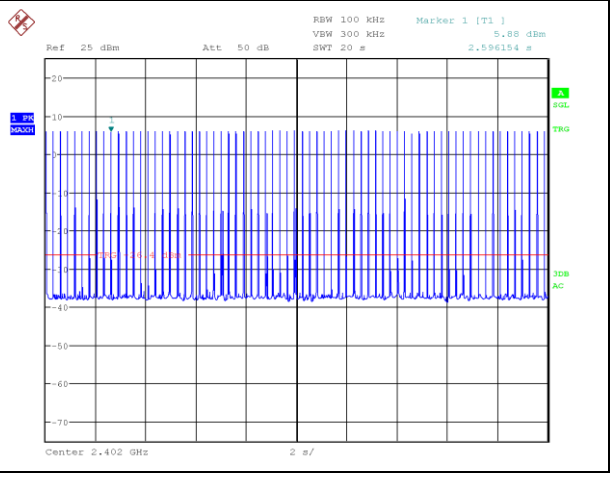
TEST: Average time of occupancy			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	23°C	
	Relative Humidity (%)	36%	
	Air pressure (hPa)	1033	
—	Power Supply & Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	Sma connector	
Equipment mode:	Operation mode	#2	
FCC Standard	§15.247 (A) (1) (III)		
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2019	05/2020

Results						
Operation Mode: #2						
Channel (No.)	**Single packet duration (ms)**	**Number of hops in 20 s**	**(hops) normalized to 31,6 sec**	**Average time of occupancy (ms)**	**Limit of Average time of occupancy (ms)**	**Plot (No.)**
1 (Low)	3,151	69	109	344	400	1÷2
*= (20 sec. / time between next hop) / single packet duration						

Plot n°1 and n°2





TEST: Additional provisions to the general radiated emission limitations.			**PASS**
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	37%	
	Air pressure (hPa)	1020	
—	Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	---------	
Equipment mode:	Operation mode	#1 #2	
FCC Standard	§15.215 (A) (B) (C)		
(A) The regulations in §§ 15.217-15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.			
(B) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.			VERDICT PASS
(C) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least			VERDICT PASS

END OF TEST REPORT