LAB N° 1356

Test Report

47 CFR FCC Part 15 subpart C
Intentional Radiators

Report reference no. ..... :	28113231-011
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 ..... :	18/10/2019
Total number of pages ..... :	43 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
FCC ID ..... :	Y9ZMT15H7WS6
Ratings ..... :	3Vdc (2x1,5Vdc type AA or rechargeable internal battery)
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

The results in this Test Report are exclusively referred to the tested samples. Without the written authorization of TÜV Rheinland Italia S.r.l., this document can be reproduced only integrally

SUMMARY

1. Release Control Record

Test report Number	Reason of change	Date of Issue
28113231-003	Original release	06/05/2019
28113231-007	Correct model name, added derived models table. This version cancel and replaces full test report nr.28113231-003 issue date 06/05/2019 and its previous versions	24/05/2019
28113231-011	Adjusted PSD and Power limit This version cancel and replaces full test report nr.28113231-007 issue date 24/05/2019 and its previous versions	18/10/2019

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
558074 D01 DTS Meas Guidance v05 - August 24, 2018	Guidance for performing compliance measurements on digital transmission systems (DTS) operating under §15.247

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	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications:	
§ 15.247 (a) (1)	20 dB Bandwidth	N.A. [1]
§ 15.247 (a) (1) (i)	Number of Hopping Channels Used, Carrier frequency Separation and Time occupancy in band 902÷908MHz	N.A. [1]
§ 15.247 (a) (1) (ii)	Number of Hopping Channels Used, Carrier frequency Separation and Time occupancy in band 5725÷ 5850 MHz	N.A. [1]
§ 15.247 (a) (1) (iii)	Number of Hopping Channels Used, Carrier frequency Separation and Time occupancy in band 2400÷2483,5 MHz	N.A. [1]
§ 15.247 (a) (2)	6dB Minimum Bandwidth for systems using digitally modulation	PASS
§ 15.247 (b)	Maximum Peak Output Power:	
§ 15.247 (b) (1)	Peak Output Power (conducted) in band 2400÷2483,5 MHz and 5725÷ 5850 MHz (Hopping systems)	N.A. [1]
§ 15.247 (b) (2)	Peak Output Power (conducted) in band 902÷908MHz (Hopping systems)	N.A. [1]
§ 15.247 (b) (3)	RF power output (conducted) for systems using digitally modulation	PASS
§ 15.247 (b) (4)	Antenna gain	PASS
§ 15.247 (c)	Operation with directional antenna gains greater than 6 dBi	PASS
§ 15.247 (d)	Out-of-band emissions	PASS
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (e)	Power Spectral Density	PASS
§ 15.247 (f)	Hybrid systems	N.A. [3]
§ 15.247 (g)	FHSS Transmission characteristics	N.A. [1]
§ 15.247 (h)	Recognition of occupied channel and multiple transmission system	N.A. [1]
§ 15.247 (i) (§ 47CFR 1.1307(b)(1))	RF humane exposure	PASS

Note 1	Not applicable for DTS equipment
Note 2	No hybrid system

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.

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"(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.

4. General product information

Description: Hearing protection and communication solution for high noise environments

3M | PELTOR™

Model: WS Series Peltor - MT15H7AWS6

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

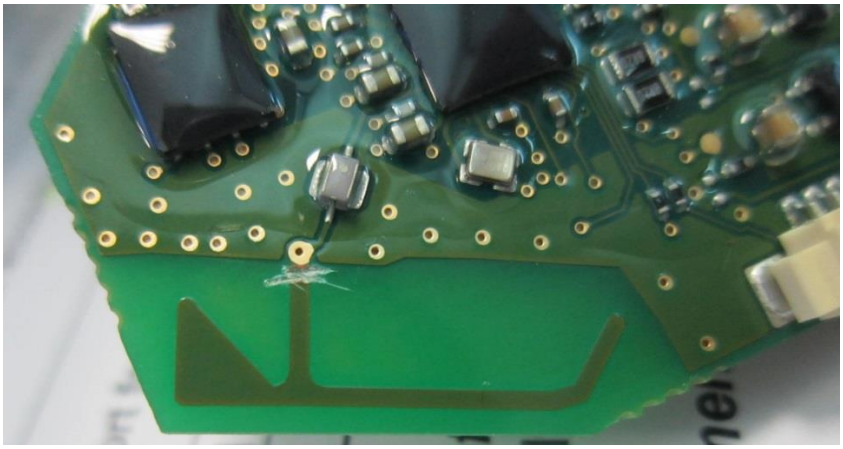
5. General Chipset information

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

6. General Antenna information



As declared by the manufacturer: antenna gain +6.55dBi

7. 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

8. 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

9. Power Interface

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

10. 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

11. EUT Operation Modes

Operation mode	Description
#1	Continuous Bluetooth Low Energy Modulation RF Transmission (DTS) RF setting during tests: Frequency: 2402MHz (low channel); 2440MHz (mid channel); 2480MHz (high channel); Max. Power setting. Duty cycle: 40%

BLE frequency (Transmission) DTS – Declared by applicant

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	**2402 MHz**	01	2404 MHz	02	2406 MHz	03	2408 MHz
04	2410 MHz	05	2412 MHz	06	2414 MHz	07	2416 MHz
08	2418 MHz	09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz	15	2432 MHz
16	2434 MHz	17	2436 MHz	18	2438 MHz	19	**2440 MHz**
20	2442 MHz	21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz	27	2456 MHz
28	2458 MHz	29	2460 MHz	30	2462 MHz	31	2464 MHz
32	2466 MHz	33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz	39	**2480 MHz**

12. EUT Configuration Modes

Description

PAR.	TEST	EUT OPERATION MODES
§ 15.203 § 15.247 (b) (4) (i)	Antenna Requirements	#1
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	#1
§ 15.247 (a) (2)	6 dB minimum Bandwidth	#1
§ 15.247 (b) (3)	RF power output (conducted) for systems using digitally modulation	#1
§ 15.247 (c)	Operation with directional antenna gains greater than 6 dBi	#1
§ 15.247 (d)	Out-of-band emissions	#1
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	#1
§ 15.247 (e)	Power Spectral Density	#1
§ 15.247 (i) (§ 47CFR 1.1307(b)(1))	RF humane exposure	#1

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)

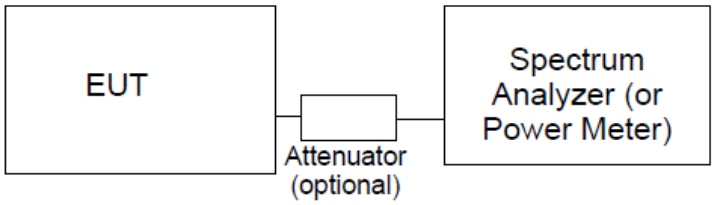
25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

13. 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	3Vdc	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.

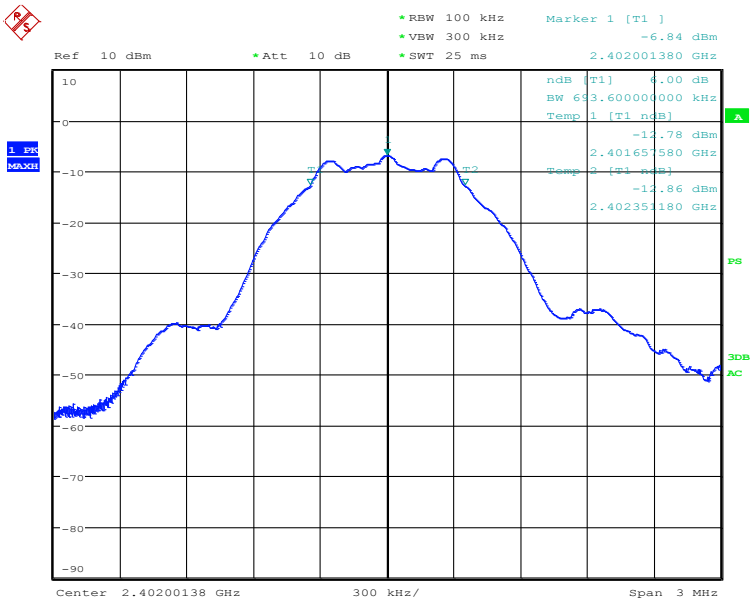
Antenna specifications	
N° of authorized antenna types	---
Antenna type	Internal PCB antenna
Maximum total gain	As delcared by the manufacturer, antenna gain +6,55dBi
External power amplifiers	Not present

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

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

Test Method Used
According to Par. 8.2 of KDB 558074 D01 15.247 Meas Guidance v05 (and par. 11.8.1 Option 1 of ANSI C63.10)

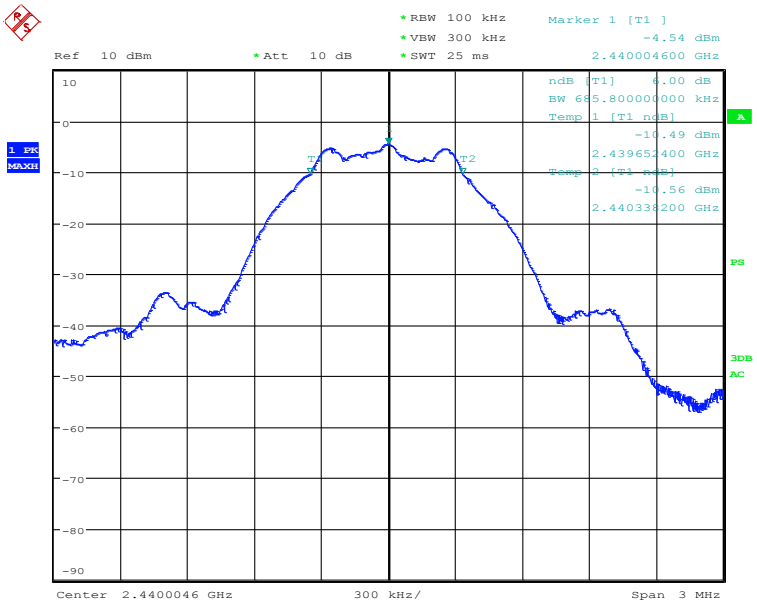
Graphical representation of 6dB Bandwidth
Operation Mode: #1 – Low Channel (2402 MHz)



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)
Low	2402	693.60

Bandwidth at -6dB (Fmin and Fmax)			
Fmin	2401,65 MHz	Fmax	2402,35 MHz

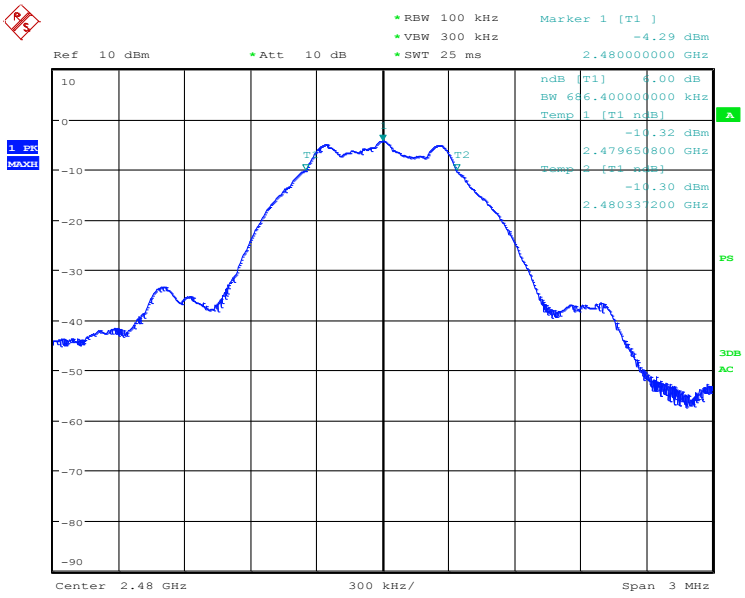
Graphical representation of 6dB Bandwidth
Operation Mode: #1 – Middle Channel (2440 MHz)



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)
Middle	2440	685.80

Bandwidth at -6dB (Fmin and Fmax)			
Fmin	2439,65 MHz	Fmax	2440,33 MHz

Graphical representation of 6dB Bandwidth
Operation Mode: #1 – High Channel (2480 MHz)



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)
High	2480	686.40

Bandwidth at -6dB (Fmin and Fmax)			
Fmin	2479,65 MHz	Fmax	2480,33 MHz

TEST: RF power output, conducted (ERP)			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	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc internal battery	RF Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (B) (3)		

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

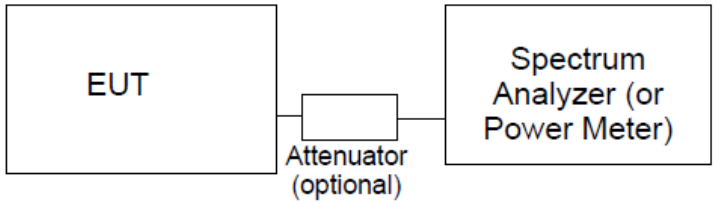
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(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.

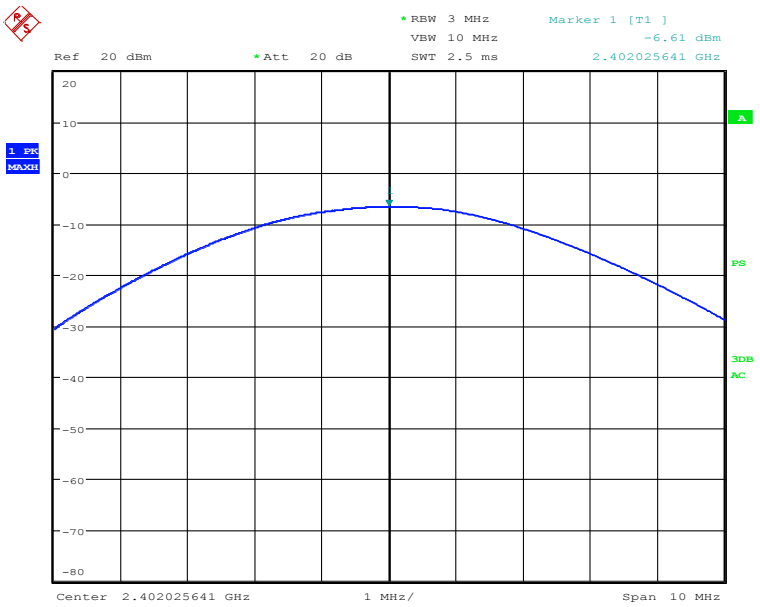
Further information to test setup



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

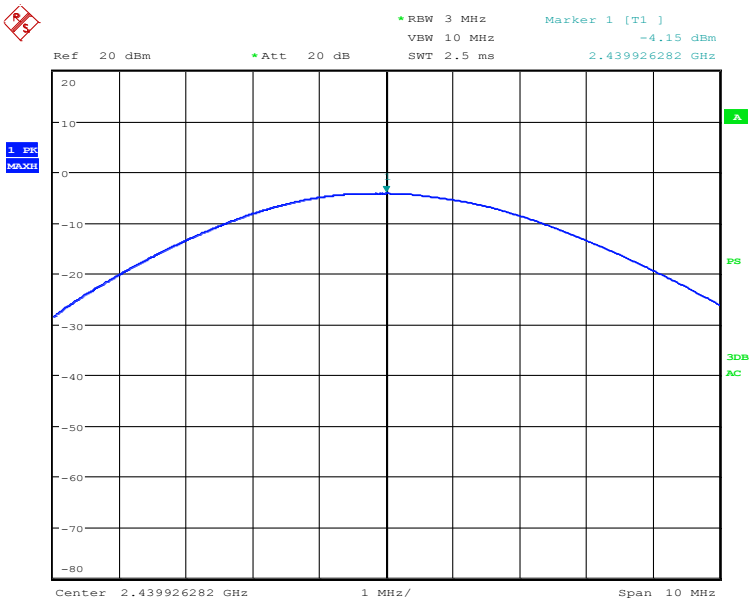
Test Method Used
According to Par. 8.3.1.1 of KDB 558074 D01 15.247 Meas Guidance v05 (and par. 11.9.1.1 RBW ≥ DTS bandwidth of ANSI C63.10)

Graphical representation of RF power output
Operation Mode: #1 – Low Channel (2402 MHz)
Plot n°1



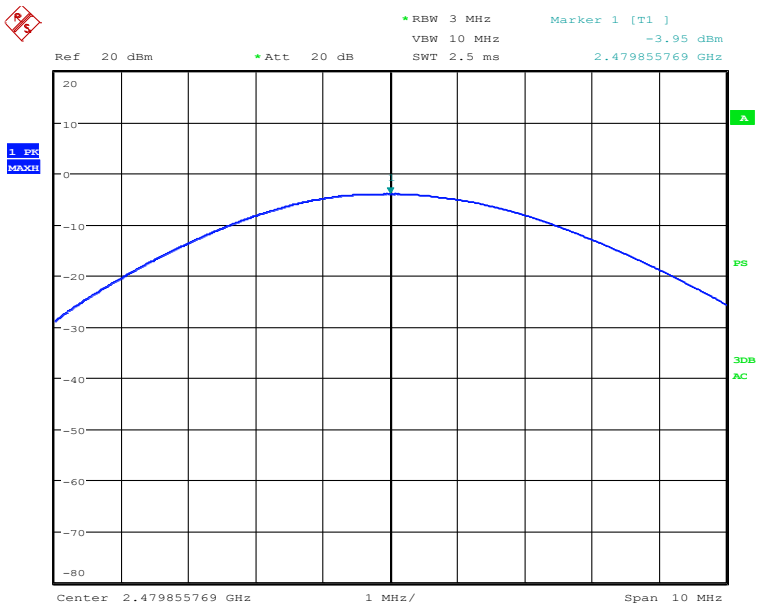
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
Low	2402	-6.61	0.22	29.45

Graphical representation of RF power output
Operation Mode: #1 – Middle Channel (2440 MHz)
Plot n°2



Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
Middle	2440	-4.15	0.38	29.45

Graphical representation of RF power output
Operation Mode: #1 – High Channel (2480 MHz)
Plot n°3

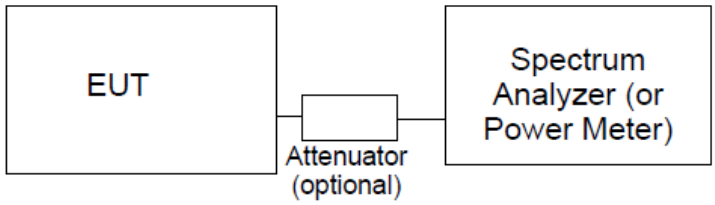


Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		(dBm)	(mW)	
High	2480	-3.95	0.40	29.45

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	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc	RF Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (D)		

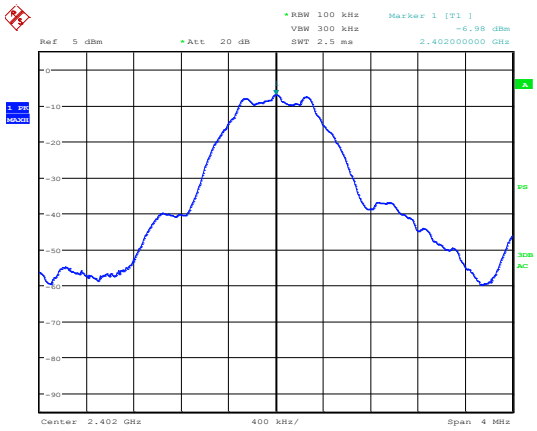
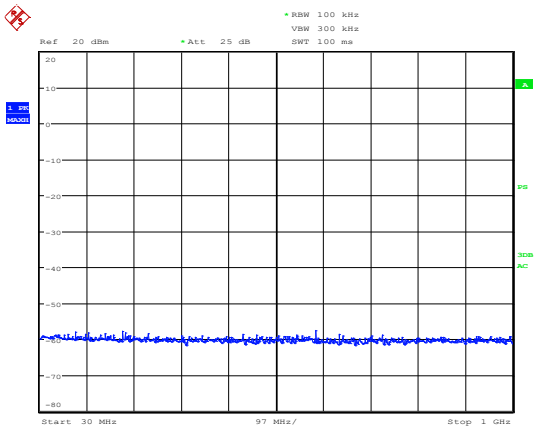
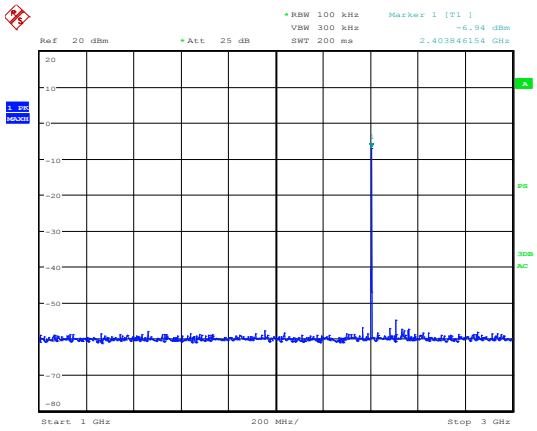
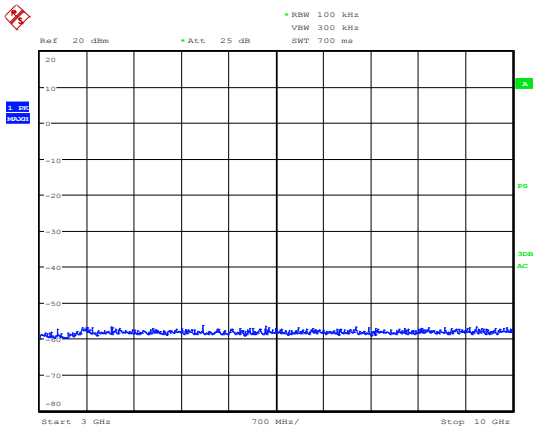
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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)).

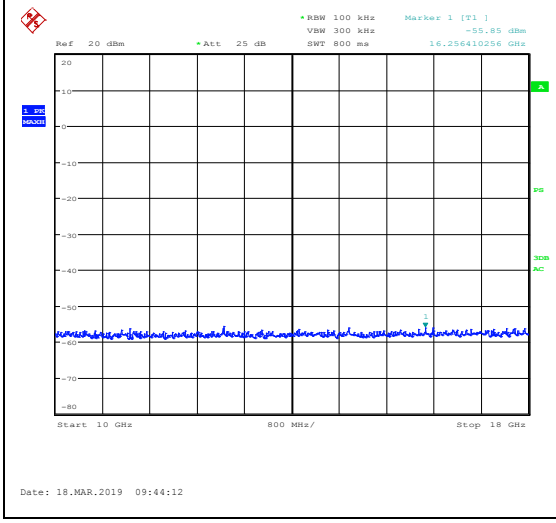
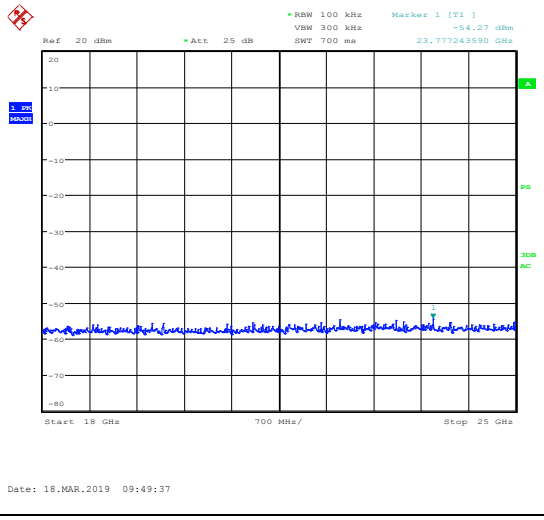
Further information to test setup



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

Test Method Used
According to Par. 8.5 of KDB 558074 D01 15.247 Meas Guidance v05 (and par. 11.11 of ANSI C63.10) If the maximum peak conducted output power procedure was used to determine compliance as described in 11.9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – Low Channel (2402 MHz)	
Fundamental	Frequency: 30MHz – 1000MHz
	
Frequency: 1GHz – 3GHz	Frequency: 3GHz – 10GHz
	

Frequency: 10GHz – 18GHz	Frequency: 18GHz – 25GHz
	

Frequency (MHz)	Measured power (dBm)	Fundamental Level (dBm)	Difference Peak / Spurious (dB)	Peak Limit at PK power –20dB (dBm)	Margin (dB)
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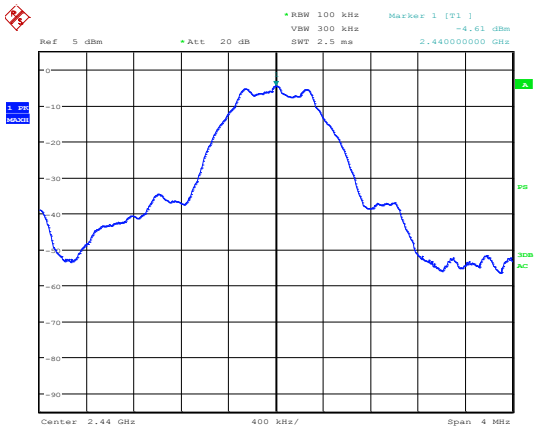
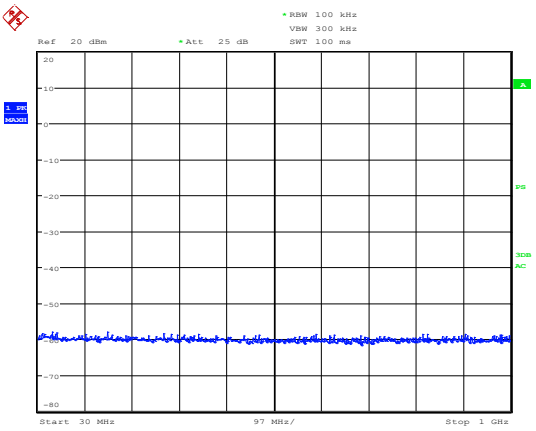
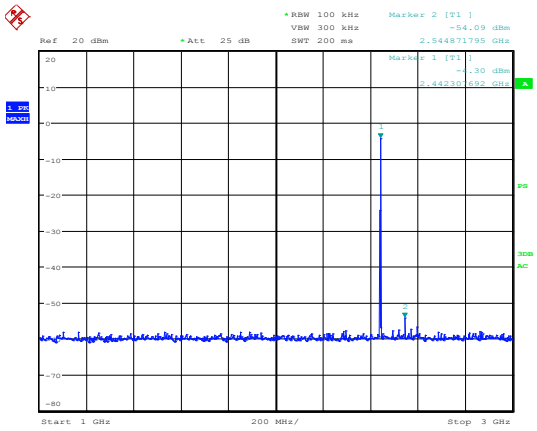
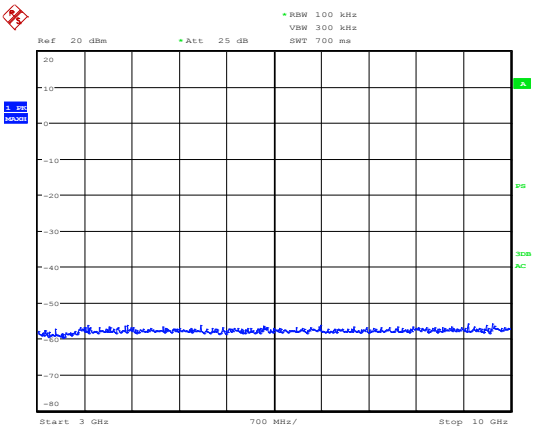
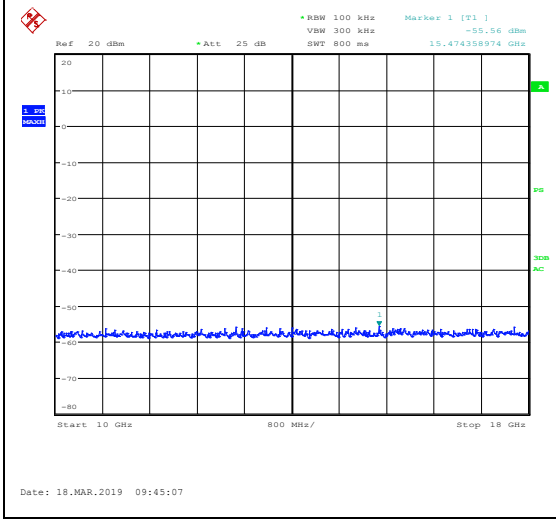
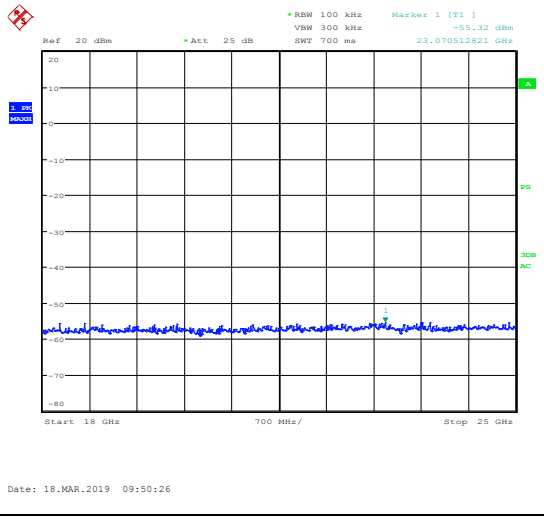
Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – Middle Channel (2440 MHz)	
Fundamental	Frequency: 30MHz – 1000MHz
	
Frequency: 1GHz – 3GHz	Frequency: 3GHz – 10GHz
	

Frequency: 10GHz – 18GHz	Frequency: 18GHz – 25GHz
	

Frequency (MHz)	Measured power (dBm)	Fundamental Level (dBm)	Difference Peak / Spurious (dB)	Peak Limit at PK power –20dB (dBm)	Margin (dB)
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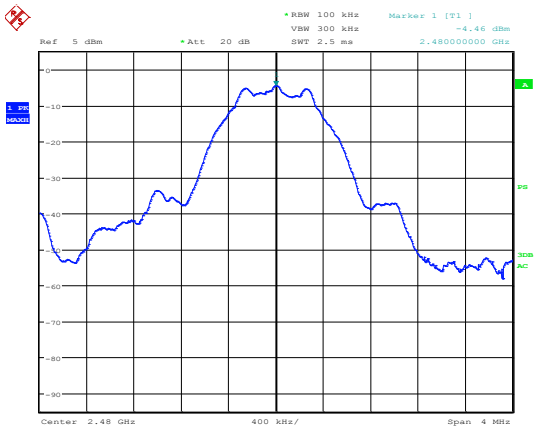
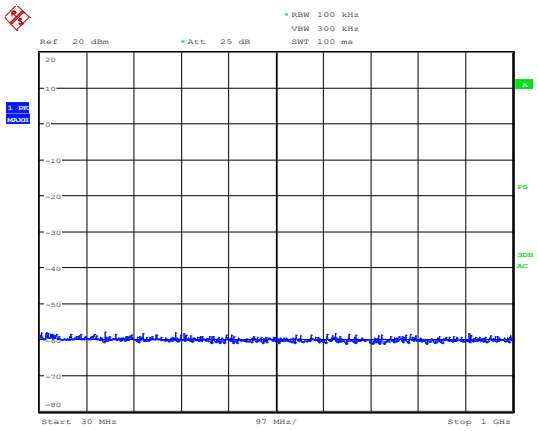
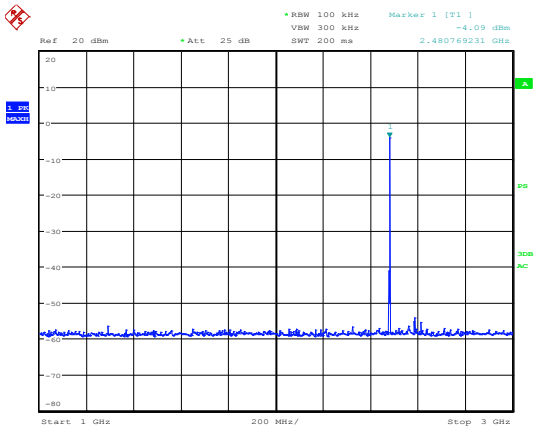
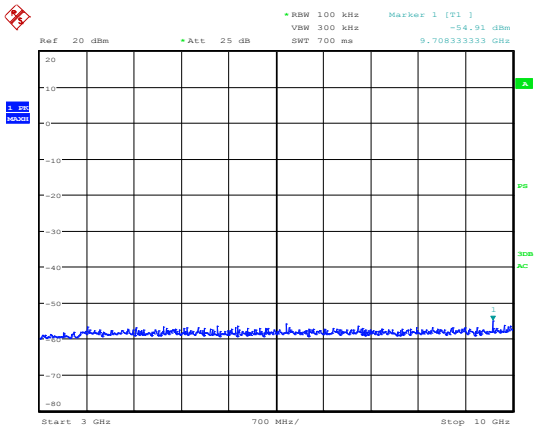
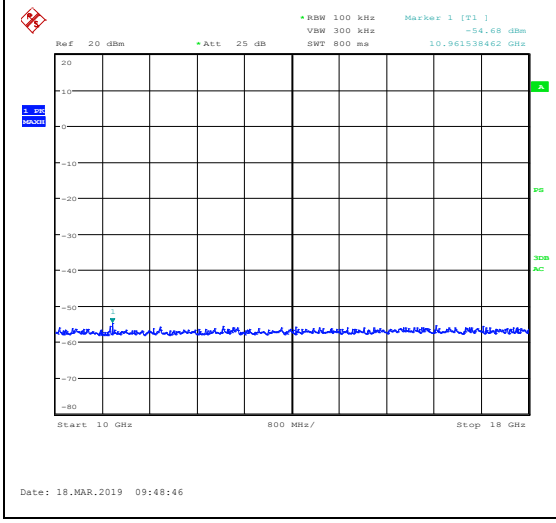
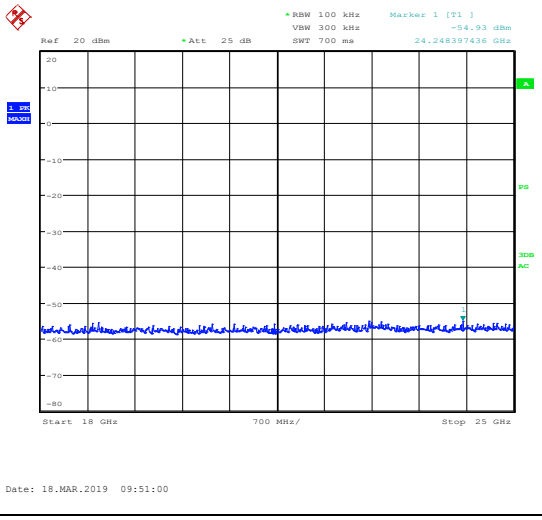
Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – High Channel (2480 MHz)	
Fundamental	Frequency: 30MHz – 1000MHz
	
Frequency: 1GHz – 3GHz	Frequency: 3GHz – 10GHz
	

Frequency: 10GHz – 18GHz	Frequency: 18GHz – 25GHz
	

Frequency (MHz)	Measured power (dBm)	Fundamental Level (dBm)	Difference Peak / Spurious (dB)	Peak Limit at PK power –20dB (dBm)	Margin (dB)
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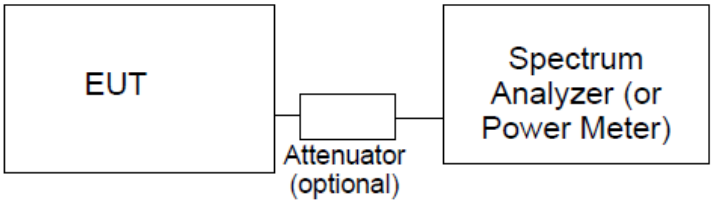
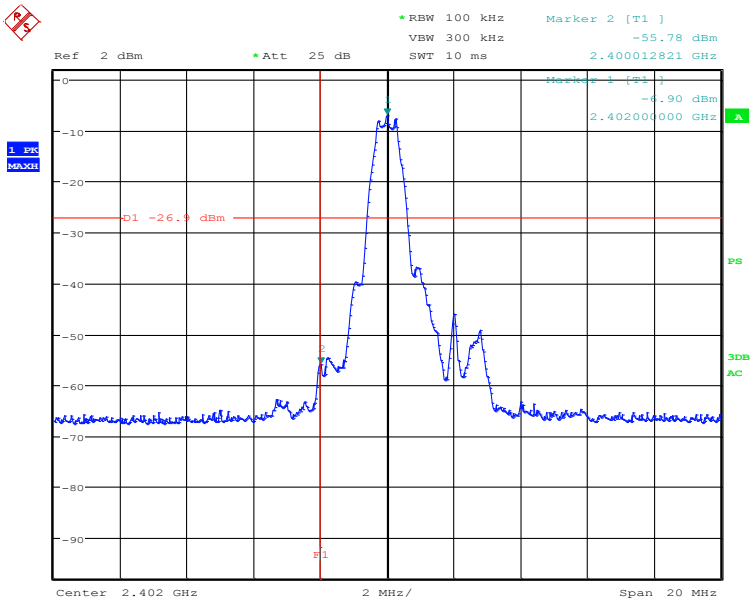
TEST: 100 kHz Bandwidth of Frequency Band Edges			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	52%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	24V ac / 60Hz	RF 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 (conducted)			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

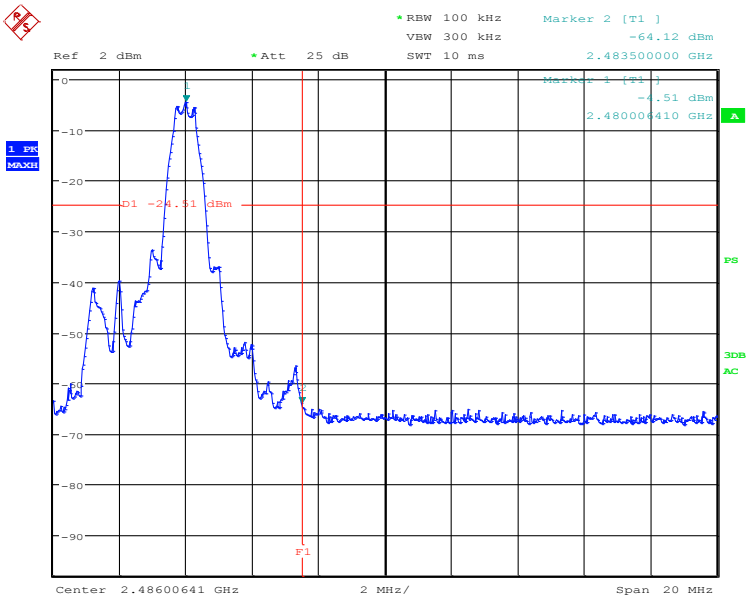
Test Method Used
According to Par. 8.7.2 (Marker-Delta method) of KDB 558074 D01 15.247 Meas Guidance v05 (and par. 11.13.2 of ANSI C63.10)

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – Low Channel (2402 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)
2400	**-55.78**	**-6.90**	**48.88**	**-26.90**	**28.78**

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



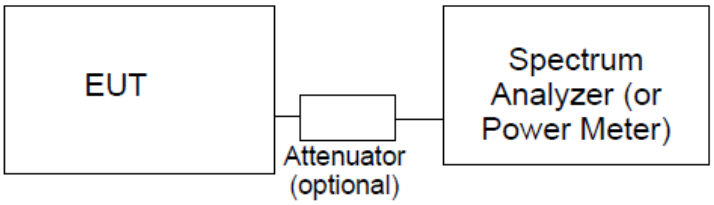
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
2483,5	**-64.12**	**-4.51**	**59.61**	**-24.51**	**39.61**

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	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc internal powered	---------	
Equipment mode:	Operation mode	#1	
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

TEST: Power Spectral Density			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	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	3Vdc internal powered	RF Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (E)		

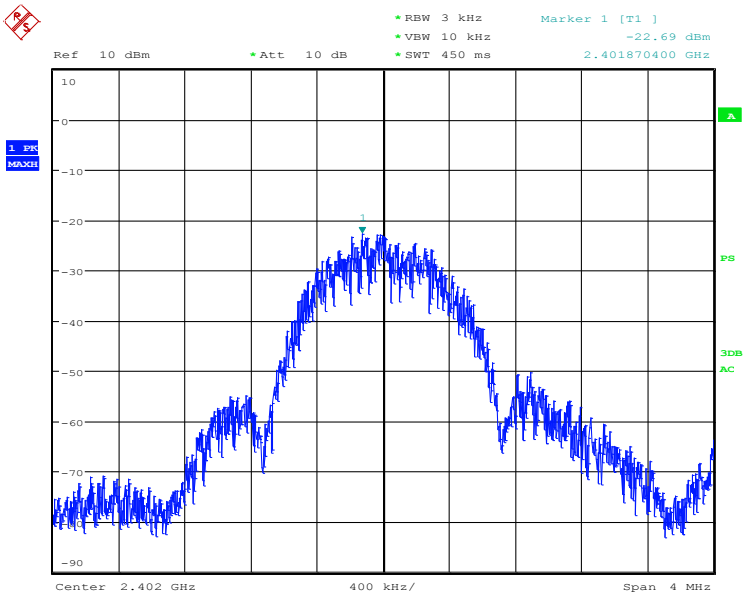
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions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

Further information to test setup	

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU 40	2782345	05/2018	05/2019

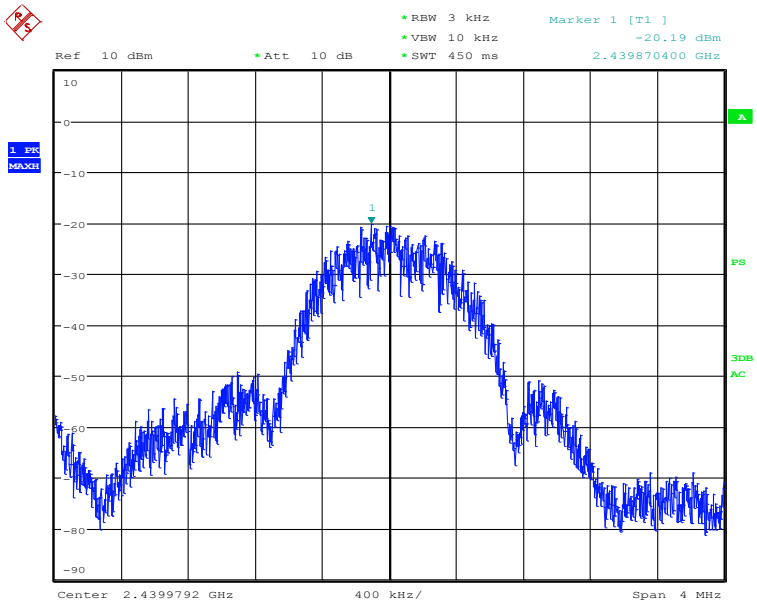
Test Method Used
According to Par. 8.4 of KDB 558074 D01 15.247 Meas Guidance v05 (and par. 11.10.2 Method PKPSD (peak PSD)

Graphical representation of Power Spectral Density
Operation Mode: #1 – Low Channel (2402 MHz)



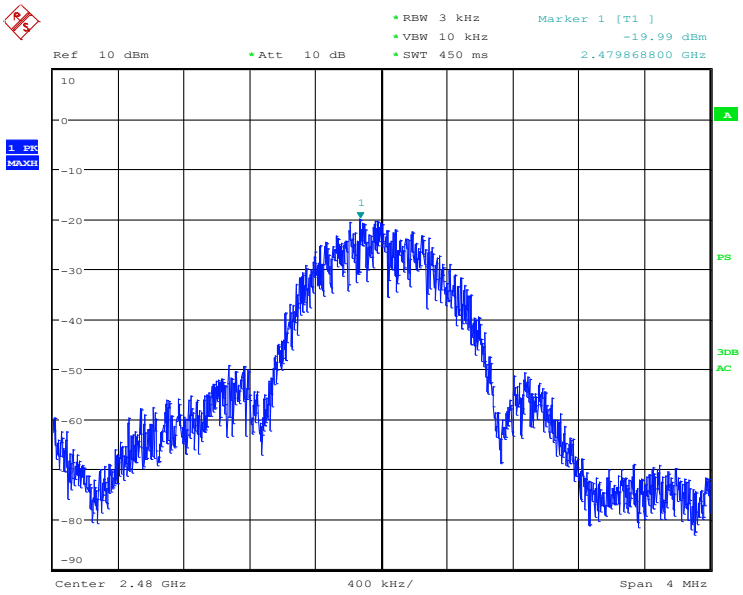
Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
Low	2402	-22.69	7.45

Graphical representation of Power Spectral Density
Operation Mode: #1 – Middle Channel (2440 MHz)



Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
Middle	2440	-20.19	7.45

Graphical representation of Power Spectral Density
Operation Mode: #1 – High Channel (2480 MHz)



Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
High	2480	-19.99	7.45

TEST: RF Exposure 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)	---	
	Relative Humidity (%)	---	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	24V ac / 60Hz	---	
Equipment mode:	Operation mode	#1	
FCC Standard	47 CFR 2.1093		
Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines 47 CFR 2.1093 - Radiofrequency radiation exposure evaluation: portable devices			
EUT classification (fixed, mobile or portable devices)	Portable device		
Limits Freq. Range 2402÷2480MHz	See next table		

Appendix A

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

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table. The equation and threshold in 4.3.1 must be applied to determine SAR test exclusion.

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

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	*SAR Test Exclusion Threshold* (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Note: 10-g Extremity SAR Test Exclusion Power Thresholds are 2.5 times higher than the 1-g *SAR Test Exclusion Thresholds* indicated above. These thresholds do not apply, by extrapolation or other means, to occupational exposure limits.

Operating Condition #1						
Frequency	**Max Conducted Output Power (P)**	**Numeric Antenna Gain (G)**	**Max Radiated Output Power (P)**	**Max Radiated Output Power (P)**	**Separation distance**	**Exemption Limit (obtained by linear interpolation) (mW)**
(MHz)	**(dBm)**	**/**	**(dBm)**	**(mW)**	**(mm)**	
2402	-6.61	4.52	-2.09	0.62	≤5	10.11
2440	-4.15	4.52	0.37	1.09	≤5	10.05
2480	-3.95	4.52	0.57	1.14	≤5	9.98
VERDICT						
SAR evaluation is not required because the output power value is less than exemption limit **(separation distance ≤5mm)**						

Note:
G = Numeric Gain ($10^{(dBi/10)}$)
When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

12. MEASUREMENT UNCERTAINTY

TEST	Expanded uncertainty	Coverage probability	Coverage factor
6 dB minimum Bandwidth	0,25% of reading value	95%	2,3
RF power output (conducted)	1,2 dB	95%	2,2
Out-of-band emissions	1,2 dB	95%	2,2
100 kHz Bandwidth of Frequency Band Edges	1,2 dB	95%	2,2
Power Spectral Density	1,2 dB	95%	2,2

13. ANNEX	
Photographic Documentation	
Set-up conducted photo on RF connector	See Report n° 28113231-001 Annex 1

END OF TEST REPORT