

Test report

according to ISO/IEC 17025:2017

FCC (Federal Communications Commission) Test Firm Registration Number: 768032 Designation Number DE0022

ISED (Inovation, Science and Economic Development) CAB identifier: DE0012 ISED#: 6155A

Electromagnetic compatibility

Intentional Radiators



DAkkS Deutsche Akkreditierungsstelle D-PL-17379-01-00 D-PL-17379-01-02 D-PL-17379-01-03



BNetzA-CAB-18/21-19

Test report no .:



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20/03-0028

Page 1 of 105 pages



Table of contents

1.	Client information	3
2.	Equipment under test (EUT)	3
3.	Description of the Equipment under test and test conditions	4
4.	Performed measurements and results	6
5.	AC Mains conducted emissions	7
6.	Radiated emission measurements	18
7.	Operation within the band 902-928 MHz, 2400-2483,5 MHz and 5725-5850 MHz	29
8.	Test equipment	96
9.	Test Setups	
10.	Measurement uncertainty	
11.	Photos setup	
12.	Conclusions	
13.	Photos of tested sample	

Location of test facility:



STC Germany GmbH Ohmstrasse 1 84160 Frontenhausen Germany

1. Client information

Name:	DALI A/S
Address:	Dali Allé 1, 9610 Norager, Denmark
Name of contact:	Søren Johnsen
Telephone:	+4522760349
Fax:	-/-
E-mail:	sjo@dali.dk

2. Equipment under test (EUT)

2.1 Identification of the EUT

Equipment:	Control preamplifier and source selection hub for DALI wireless speaker systems
Model:	DALI SOUND HUB COMPACT
Brand name:	DALI
Serial no.:	-/-
Manufacturer:	DALI Audio Manufactoring (Ningbo) Co., Ltd Buiding 2, No. 1188, Zhongguan Road Zhenhai, Ningbo, China. 315221
Country of origin:	China
Power rating:	AC-Adaptor: DY9812-090130-19920C 100-240 V ~ ; 50/60 Hz ; 0.35 A max. 9 V = ; 1.3 A
Highest frequency generated or used in the device or on which the device operates or tunes:	5875 MHz
Date Sample Received:	9.03.2020
Tests were performed:	4.05.2020 -19.05.2020

2.2 Additional information about the EUT:

The unintentional function of the DALI SOUND HUB COMPACT is approved over sDoC procedure. DALI SOUND HUB COMPACT contains a modular approved RF module (KLEERNET) with following ID's FCC ID: ZUC-DWAM83TB / IC: 23522- DWAM83TB, the permissive change class 2 for frequency range 5150-5250MHz of the integrated RF module is pending.

Bluetooth Low Energy is disabled by firmware.

To duplicate parts of this test report needs the written confirmation of the test laboratory.

The test results relate only to the above mentioned test sample(s).

3. Description of the Equipment under test and test conditions

FCC-ID:	2AFD2-SHC			
	20247-SHC			
HVIN:	360156-SHC			
Cables:		141.00		
Cables.	AC-Adaptor-DC cable: 141 cm			
	IR-cable:	147 cm		
Approx. Size (I x w x h):	(21.0 x 12.9 x 3.1) cm			
Test conditions:	The "Control preamplifier and source selection hub for DALI wireless speaker systems – DALI SOUND HUB COMPACT" (= equipment under test – EUT) had been tested, where applicable, in the following modes: (1) Bluetooth 5.0: Tx mode GFSK (FHSS) 2402.0 MHz (2) Bluetooth 5.0: Tx mode GFSK (FHSS) 2441.0 MHz (3) Bluetooth 5.0: Tx mode GFSK (FHSS) 2480.0 MHz (4) Bluetooth 5.0: Tx mode GFSK (FHSS) 2480.0 MHz (5) Bluetooth 5.0: Tx mode π /4-DQPSK 2402.0 MHz (6) Bluetooth 5.0: Tx mode π /4-DQPSK 2480.0 MHz (7) Bluetooth 5.0: Tx mode π /4-DQPSK 2402.0 MHz (7) Bluetooth 5.0: Tx mode π /4-DQPSK 2402.0 MHz			
 (8) Bluetooth 5.0: Tx mode 8DPSK 2441.0 MHz (9) Bluetooth 5.0: Tx mode 8DPSK 2480.0 MHz controlled by a test software with maximum RF-output per data rate in order to find the worst case. 			Hz	
	as well as in normal operation mode with an active connection to Wireless Speaker via 5 GHz (5.2 GHz and 5.8 GHz) in following modes.			
	(11) Optical Input mo (12) HDMI mode with 1 kHz sinus sigr	Input mode with 1 kHz sin ode with 1 kHz sinus file p n color bar signal with mov nal e Smartphone connected	laying ving element and	
	During tests a Monitor was connected to the EUT via HDMI and a 5 GHz wireless connection to the speaker's (DALI OBERON 7C) was established. The EUT was powered with 120 V~ 50/60Hz, as well as 240 V~ 50/60 Hz.			
Additional information:	Conducted RF Measurer socket	nents were carried out on	a temporary SMA	
RF Module Model Number:	JS-BTM343			
Frequency range:	2.400 GHz – 2.483,5 GH	7		
Operating frequencies:	2.402 GHz – 2.480 GHz	-		
Module Tranmission Type:	Bluetooth 5.0 (FHSS)			
Module frammission type.	GFSK	π/4-DQPSK	8DPSK	
Date Rates:	1 MBit/s	2 MBit/s	3 MBit/s	
Channel separation:	1 MHz	1 MHz	1 MHz	
Number of channels:	79	79	79	
Spurious Emissions: radiated lowest margin to limit	QP 39.0 dBµV/m @ 3 m	QP 38.5 dBµV/m @ 3 m	QP 39.3 dBµV/m @ 3 m	
Environmental conditions during tests:	Ambient temperature: Relative humitity	20 °C 40 %		
	Atmospheric pressure	965 mbar		

ESTC TESTED	Test report no.: 20/03-0028	Page 5 of 105 pages
	20/03-0020	

Antenna specification:	Bluetooth: Model: Printed PCB Antenna Gain: max. 2.1 dBi Type: External (with accessible antenna socket) Internal (integrated, PCB antenna)
Test standard:	 e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
	 RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	42	2444
1	2403	43	2445
2	2404	44	2446
3	2405	45	2447
4	2406	46	2448
5	2407	47	2449
6	2408	48	2450
7	2409		
8	2410	70	2472
9	2411	71	2473
		72	2474
36	2438	73	2475
37	2439	74	2476
38	2440	75	2477
39	2441	76	2478
40	2442	77	2479
41	2443	78	2480

4. Performed measurements and results

The complete list of measurements required in e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 is given below.

Standard:	Standard:	Test Method:		Tes	st requi	remen	ts:
				appli	cable:	fulfi	lled:
§ 15.207	RSS-Gen issue 5	ANSI 63.10 Section 6.2	AC Mains Conducted Emissions			\boxtimes	
§ 15.209	RSS-Gen issue 5	ANSI 63.10 Section 6.3 - 6.6	Radiated Emissions			\boxtimes	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.7	20 dB Bandwidth			\boxtimes	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.5	Output Power of Fundamental Emissions			\boxtimes	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.3	Number of Operating Channel	\boxtimes		\boxtimes	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.2	Carrier Frequency Separation	\boxtimes		\boxtimes	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.6	Band Edges Measurement	\boxtimes		\square	
§15.247	RSS-247 issue 2	ANSI 63.10 Section 7.8.4	Occupancy Time (Dwell time)	\boxtimes		\boxtimes	
	RSS-Gen issue 5	ANSI 63.10 Section 6.9.3	99% Power Bandwidth	\boxtimes		\square	

All required / applicable tests according to the following standards were performed under Ref-No. 20/03-0028.

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 with test Method according to ANSI C63.10-2013

-RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

- e-CFR data is current as of May 11, 2020

Remark: -/-



5. AC Mains conducted emissions

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.207 Conducted limits -RSS-Gen issue 05 section 7.2

Test site

Measurements of conducted emission from EUT was made in the shielded chamber (DC - 10GHz) located in the test facility.

Test equipment and test set up

Test equipment used for conducted measurements on Mains as given in clause Test equipment of this report.

Test setup used for conducted measurements on Mains as given in clause Test setups of this report.

Detector function selection and bandwidth

In conducted emissions measurement CISPR quasi-peak- and average-detector were used. The bandwidth of the detector of instrument is 10 kHz over the frequency range of 150 kHz to 30 MHz.

Frequency range to be scanned

For conducted emission measurements, the spectrum in the range of 150 kHz to 30 MHz was investigated.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under "Test conditions" in clause 3 of this report

All modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation and for each ac power current-carrying conductor, cable manipulation are performed within the range of likely configurations. The highest values measured are shown in the table below. The corresponding configuration is shown in the "Photo(s) of test setup".

The EUT was placed on a 80 cm high non metallic table. Measurements were performed on the AC terminals of the Host AC-Adaptor, on neutral (N)- and live (L1)-wire had been performed.

Requirements

Frequency Range	Quasi-Peak Limits	Average Limits		
[MHz]	[dBµV]	[dBµV]		
0.15 - 0.5	66 to 56 Note 1	56 to 46 Note 1		
0.5 - 5.0	56	46		
5.0 - 30.0 60 50				
Note 1: The level decreases linearly with the logarithm of the frequency				

Measurement

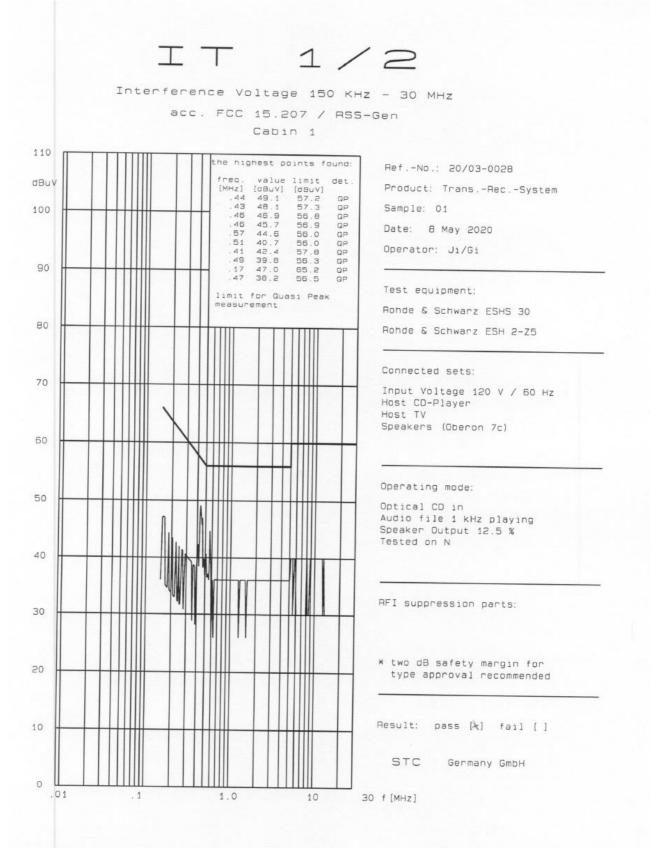
Measruement performed on 08.05.2020

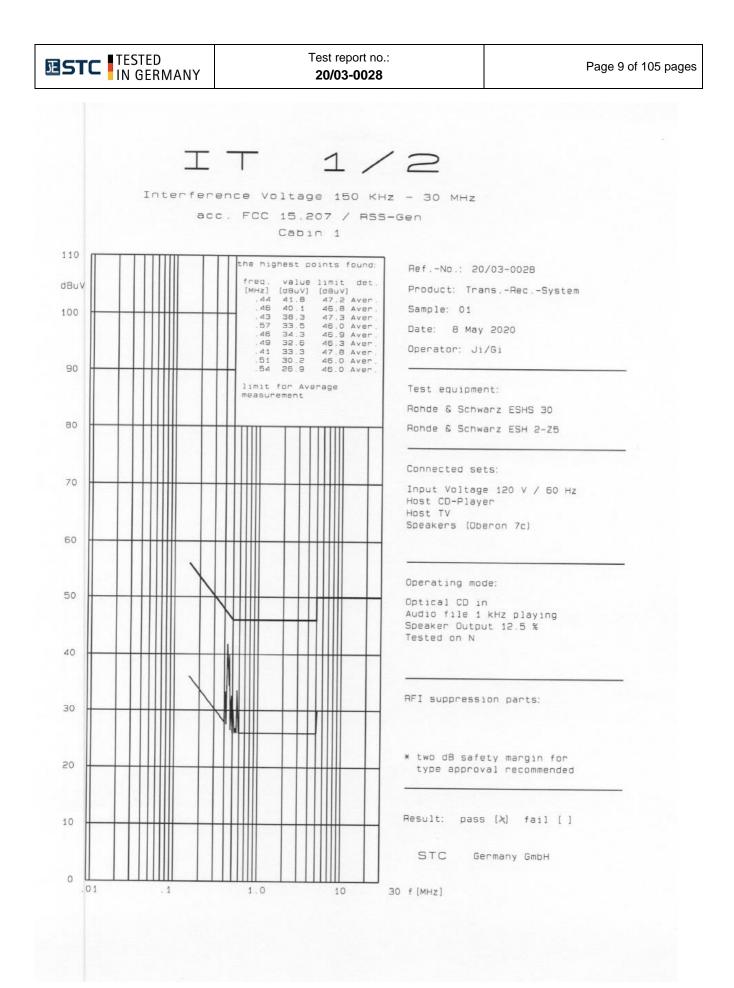
As worst cases the mode No.: 11 with an input voltage of 120 V / 60 Hz was found and documented in this report. Additional the Bluetooth mode No.: 13 is also documented in this report.



Page 8 of 105 pages

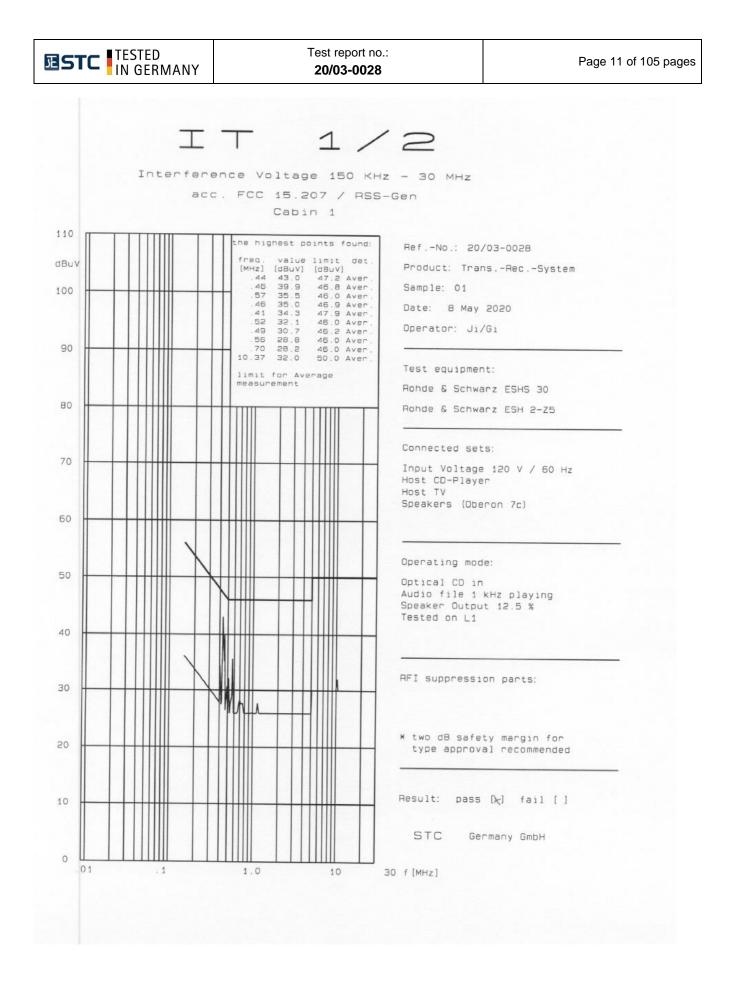
Mode No.: 11





STC IN G	ED ERMANY	Test report no.: 20/03-0028	Page 10 of 105 pa
	I	T 1/2	
		nce Voltage 150 KHz - 30	MHz
		. FCC 15.207 / RSS-Gen	
110		Cabin 1	
dBuV		free value limit det	lo.: 20/03-0028 t: TransRecSystem
100		.44 49.7 57.2 QP .57 45.6 56.0 QP .46 46.2 56.8 QP	
		.46 45.0 55.9 GP Date: .41 43.3 57.9 GP Date: .52 41.4 55.0 GP	8 May 2020
90		.43 42.8 57.4 GP Uperat .51 39.5 55.0 GP .49 39.0 55.2 GP	or: Ji/Gi
		limit for Quasi Peak	quipment:
80			& Schwarz ESHS 30 & Schwarz ESH 2-Z5
70			ted sets:
			Voltage 120 V / 60 Hz D-Player V
60		Speake	rs (Oberon 7c)
		N+III	
50			ing mode:
		Audio	l CD in file 1 kHz playing r Output 12.5 %
40		Tested	
30		RFI sup	opression parts:
20			dB safety margin for approval recommended
			and and an an
10		Result:	pass [X] fail []
		STC	C Germany GmbH
			set many billion
.01	. 1	1.0 10 30 f [MHz]	

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	Test report no.:	Dage 12 of 105 pages
ESTC IN GERMANY	20/03-0028	Page 12 of 105 pages

The six highest emissions	for each port	(L/N)/detector are	as following:
		(

Frequency [MHz]	Reading of test receiver [dBµV]	Detector	Port	loss of cable between LISN and test receiver [dB]	LISN correction [dB]	AC power line conducted emission [dBμV]	Limit [dBµV]	Result
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.44	48.9	QP	N	0.10	0.10	49.1	57.2	Pass
0.43	47.9	QP	Ν	0.10	0.10	48.1	57.3	Pass
0.46	46.7	QP	Ν	0.10	0.10	46.9	56.8	Pass
0.57	44.4	QP	Ν	0.10	0.10	44.6	56.0	Pass
0.51	40.5	QP	Ν	0.10	0.10	40.7	56.0	Pass
0.41	42.2	QP	Ν	0.10	0.10	42.4	57.8	Pass
0.44	41.8	AV	Ν	0.10	0.10	41.8	47.2	Pass
0.46	39.9	AV	Ν	0.10	0.10	40.1	46.2	Pass
0.43	38.1	AV	Ν	0.10	0.10	38.3	47.3	Pass
0.57	33.3	AV	Ν	0.10	0.10	33.5	46.0	Pass
0.49	32.4	AV	Ν	0.10	0.10	32.6	46.3	Pass
0.41	33.1	AV	N	0.10	0.10	33.3	47.8	Pass
0.44	49.5	QP	L1	0.10	0.10	49.7	57.2	Pass
0.57	45.4	QP	L1	0.10	0.10	45.6	56.0	Pass
0.46	46.0	QP	L1	0.10	0.10	46.2	56.8	Pass
0.41	43.1	QP	L1	0.10	0.10	43.3	57.9	Pass
0.52	41.2	QP	L1	0.10	0.10	41.4	56.0	Pass
0.43	42.6	QP	L1	0.10	0.10	42.8	57.4	Pass
0.44	42.8	AV	L1	0.10	0.10	43.0	47.2	Pass
0.46	39.7	AV	L1	0.10	0.10	39.9	46.8	Pass
0.57	35.3	AV	L1	0.10	0.10	35.5	46.0	Pass
0.41	34.1	AV	L1	0.10	0.10	34.3	47.9	Pass
0.52	31.9	AV	L1	0.10	0.10	32.1	46.0	Pass
0.49	30.5	AV	L1	0.10	0.10	30.7	46.2	Pass

(1) = test frequency

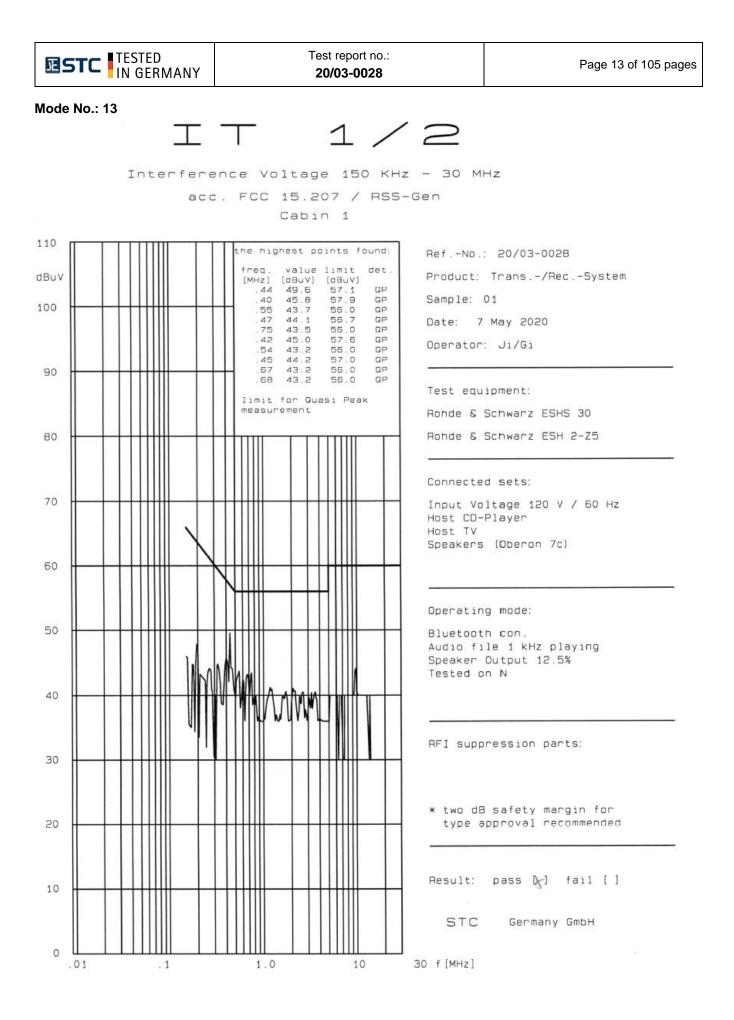
(2) = Reading of test receiver in $dB\mu V$ without correction factors

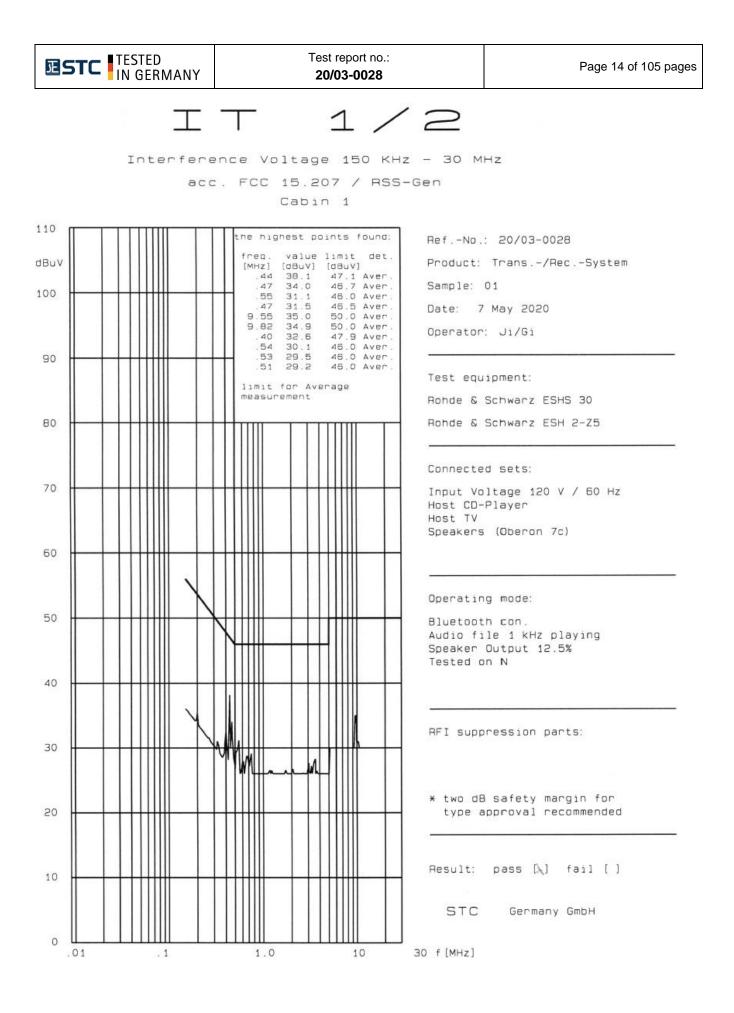
(3) = used detector

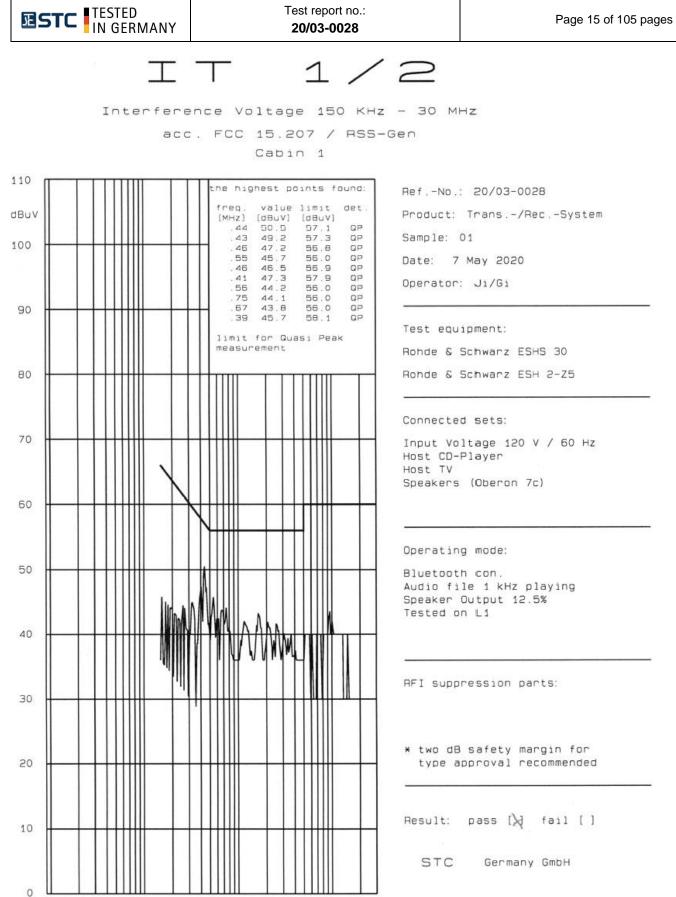
- (4) = tested port Phase (live, L1) or Neutral (N)
- (5) = loss of cable between LISN and test receiver in dB

(6) = correction factor of LISN in dB

- (7) = Reading of test receiver [dBµV] (2) + loss of cable between Line impedance stabilisation network (LISN) and test receiver (dB) (5) + LISN correction [dB] (6)
- (8) = relevant limit in $dB\mu V$
- (9) = comparison between Limit [dBµV] (7) / (8) and AC power line conducted emission [dBµV]







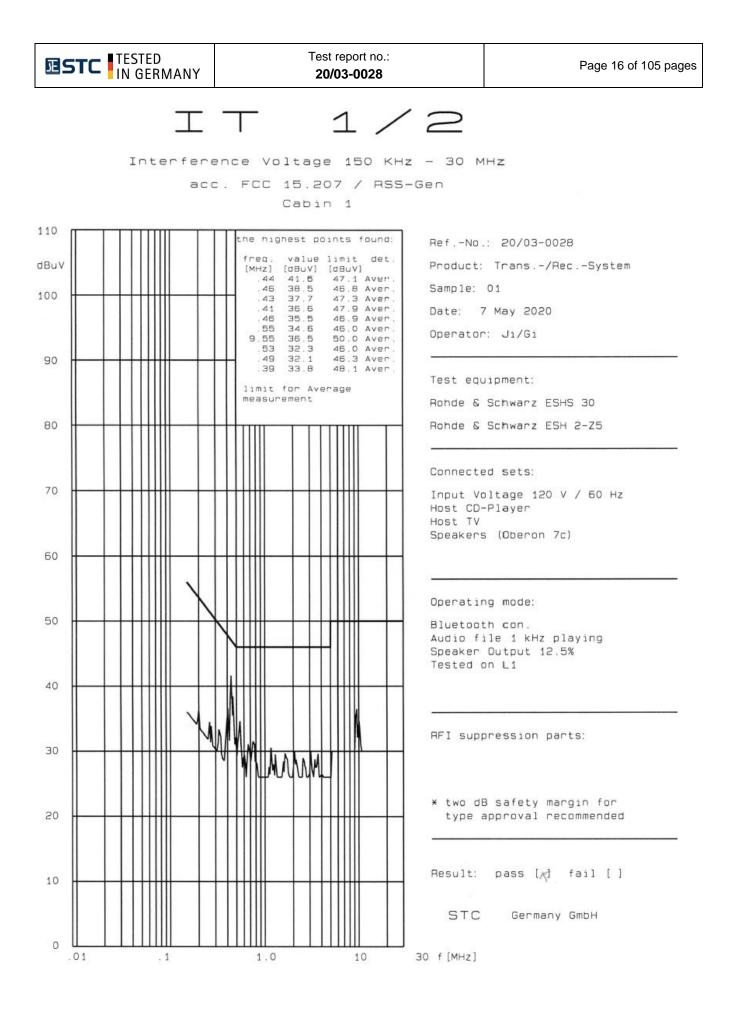
30 f [MHz]

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ESTC IN GERMANY	Test report no.: 20/03-0028	Page 17 of 105 pages
	20/03-0020	

The six highest emissions for each port (L/N)/detector are as following:

Frequency [MHz]	Reading of test receiver	Detector	Port	loss of cable between LISN and test	LISN correction [dB]	AC power line conducted	Limit [dBµV]	Result
	[dBµV]			receiver [dB]		emission		
		(-)		<i>(</i> _)		[dBµV]	(-)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.44	49.6	QP	Ν	0.10	0.10	49.8	57.1	Pass
0.40	45.8	QP	Ν	0.10	0.10	46.0	57.9	Pass
0.55	43.7	QP	N	0.10	0.10	43.9	56.0	Pass
0.47	44.1	QP	N	0.10	0.10	44.3	56.7	Pass
0.75	43.5	QP	Ν	0.10	0.10	43.7	56.0	Pass
0.42	45.0	QP	Ν	0.10	0.10	45.2	57.6	Pass
0.44	38.1	AV	Ν	0.10	0.10	38.3	47.1	Pass
0.47	34.0	AV	Ν	0.10	0.10	34.2	46.7	Pass
0.55	31.1	AV	Ν	0.10	0.10	31.3	46.0	Pass
0.47	31.5	AV	Ν	0.10	0.10	31.7	46.5	Pass
9.55	35.0	AV	Ν	0.30	0.20	35.2	50.0	Pass
9.82	34.9	AV	N	0.30	0.20	35.1	50.0	Pass
0.44	50.5	QP	L1	0.10	0.10	50.7	57.1	Pass
0.43	49.2	QP	L1	0.10	0.10	49.4	57.3	Pass
0.46	47.2	QP	L1	0.10	0.10	47.4	56.8	Pass
0.55	45.7	QP	L1	0.10	0.10	45.9	56.0	Pass
0.46	46.5	QP	L1	0.10	0.10	46.7	56.9	Pass
0.41	47.3	QP	L1	0.10	0.10	47.5	57.9	Pass
0.44	41.6	AV	L1	0.10	0.10	41.8	47.2	Pass
0.46	38.5	AV	L1	0.10	0.10	38.7	46.4	Pass
0.43	37.7	AV	L1	0.10	0.10	37.9	-/-	Pass
0.41	36.6	AV	L1	0.10	0.10	36.8	-/-	Pass
0.46	35.5	AV	L1	0.10	0.10	35.7	-/-	Pass
0.55	34.6	AV	L1	0.10	0.10	34.8	-/-	Pass

(1) = test frequency

(2) = Reading of test receiver in $dB\mu V$ without correction factors

(3) = used detector

(4) = tested port Phase (live, L1) or Neutral (N)

(5) = loss of cable between LISN and test receiver in dB

(6) = correction factor of LISN in dB

(7) = Reading of test receiver [dBµV] (2) + loss of cable between Line impedance stabilisation network (LISN) and test receiver (dB) (5) + LISN correction [dB] (6)

(8) = relevant limit in $dB\mu V$

(9) = comparison between Limit $[dB\mu V]$ (7) / (8) and AC power line conducted emission $[dB\mu V]$

Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Conducted Emission**.



6. Radiated emission measurements

Test site

Measurement of radiated emissions from EUT was made in the semi-anechoic chamber SAC3 (DC to 40 GHz) located in the test facility.

Test equipment and test set up

Test equipment used for radiated measurements as given in clause Test equipment of this report. Test setup used for radiated measurements as given in clause Test Setups of this report.

Detector function selection and bandwidth

In radiated emissions measurement, an EMI test receiver with CISPR detectors was used.

Frequency range	Resolution Bandwidth
9kHz – 150kHz (Quasi Peak & Average* Detector)	200Hz
150kHz – 30MHz (Quasi Peak & Average* Detector)	9kHz
30MHz – 1GHz (Quasi Peak Detector)	120kHz
Above 1GHz (Peak & Average Detector)	1MHz

*Average Detector only in specify frequency range.

Antennas

Measurements were made using a calibrated loop antenna in the range 9 kHz – 30 MHz, as well as a calibrated bilog antenna in the range of 30 to 1000 MHz to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization in a SAC. The horizontal distance between the receiving antenna and the EUT was 3 meters.

In the range of 1 GHz to 40 GHz measurements were made using a calibrated horn antenna to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization in a SAC with floor absorbers. The horizontal distance between the receiving antenna and the EUT was 3 meters.

Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 9kHz to 40 GHz was investigated as the highest frequency generated in the EUT is 5.875 GHz.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under "Test conditions" in clause 3 of this report

During test the EUT was operated as specified in the user manual of the EUT. For frequencies below 1000 MHz the EUT was placed on a 80 cm and for frequencies above 1000 MHz the RF Transmitter modul was placed on a 150 cm high non metallic table placed on the turntable. The EUT was rotated and the antenna height was varied between 1 m to 4 m to find the maximum RF energy generated from EUT. The procedure according to ANSI C63.10:2013 is used and all modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation, cable manipulation are performed within the range of likely configurations.

Remarks:

-Correction factor included antenna factor and cable attenuation.

-In the frequency range 1 GHz – 7 GHz the Band Reject Filter 2.4 GHz (ID11243) was used to attenuate the fundamental emission.

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits -RSS-Gen issue 05 section 8.9

Requirements

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits

Frequency MHz	Limits [µV/m] Quasi-peak	Limits [dBµV/m] Quasi-peak	Limits [µV/m] Average	Limits [dBµV/m] Average	Test distance [m]
0.009 - 0.090	-/-	-/-	2400/F (kHz)	48.5 – 28.5	300
0.090 - 0.110	2400/F (kHz)	28.5 – 26.8	-/-	-/-	300
0.110 – 0.490	-/-	-/-	2400/F (kHz)	26.8 – 13.8	300
0.490 - 1.705	24000/F (kHz)	33.8 – 23.0	-/-	-/-	30
1.705 - 30.0	30	29.5	-/-	-/-	30

acc. RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [µA/m] Quasi-peak	Limits [dBµA/m] Quasi-peak	Limits [µA/m] Average	Limits [dBµA/m] Average	Test distance [m]
0.009 - 0.090	-/-	-/-	6.37/F (kHz)	-3 – -23.0	300
0.090 - 0.110	6.37/F (kHz)	-23.0 – -24.7	-/-	-/-	300
0.110 - 0.490	-/-	-/-	6.37/F (kHz)	-24.7 – -37.7	300
0.490 - 1.705	63.7/F (kHz)	-17.7 – -28.5	-/-	-/-	30
1.705 - 30.0	0.08	-22	-/-	-/-	30

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits and RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [µV/m] Quasi-peak	Limits [dBµV/m] Quasi-peak	Limits [µV/m] Average	Limits [dBµV/m] Average	Test distance [m]
30 - 88	100	40	-/-	-/-	3
88 - 216	150	43.5	-/-	-/-	3
216 - 960	200	46	-/-	-/-	3
960 - 1000	500	54	-/-	-/-	3
Above 1000	-/-	-/-	500	54	3

Measurements

The Measurement was performed on: 04.5.2020 and 19.05.2020

Result 9 kHz – 30 MHz

In the frequency range 9 kHz – 30 MHz the EUT had been scanned in a distance of 3 m and the Limit were corrected to the test distance of 3 m using a factor with 40 dB/decade acc. to 15.31 (f)(2).

As worst cases the mode No.: 13 with an input voltage of 120 V / 60 Hz was found and documented in this report.



IT 3/4 Interference radiation (9kHz – 30MHz) acc.FCC § 15.209 / RSS-Gen



Ref.-No.: 20/03-0028

Operation mode: BT conneccted; Audio File playing 1kHz; Speaker output 12,5%

Position X (9kHz - 150kHz)

Spectrum Receiver 🗵	
RBW (QPK) 200 Hz MT :	1 s EMCO-6502-E-Feld.TDF
Input 1 DC Att 10 dB Preamp O	FF Step TD Scan
Scan 😑 1QP Max	
	ASS 100 kHz
	ASS
130 dBµV/m FCC-9KHZ - 30MHz_3m.LIN	
120 dBµV/m	
110_dBµV/m	
100 dBµV/m	
90 dBµV/m	
80 dBµV/m	
70 dBµV/m	
60 dBµV/m	
50-dBµV/m	
TF	
Start 9.0 kHz	Stop 150.0 kHz

	Position: X									
Detector QP										
Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result						
9kHz- 150kHz	-/-	>20	-/-	pass						



TESTED

IT 3/4

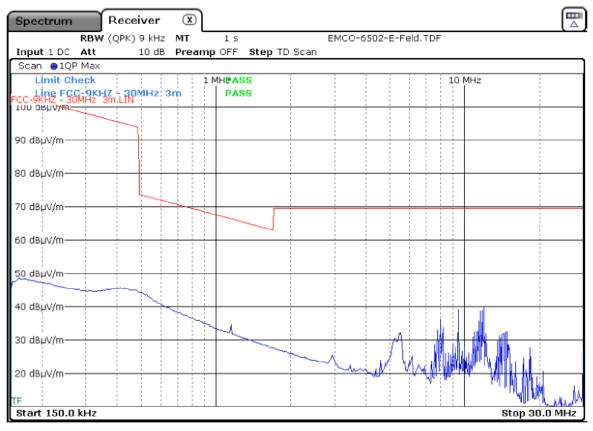
Interference radiation (9kHz – 30MHz) acc.FCC § 15.209 / RSS-Gen



Ref.-No.: 20/03-0028

Operation mode: BT connected; Audio File playing 1kHz; Speaker output 12,5%

Position X (150kHz - 30MHz)



	Position: X							
Detector QP								
Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result				
150kHz- 30MHz	-/-	>20	-/-	pass				
			+					
			1					

ESTC TESTED	Test report no.:	Page 22 of 105 pages	
IN GERMANY	20/03-0028	Fage 22 01 105 pages	

Summery result for frequency range 9 kHz - 30 MHz to show combliance with RSS-Gen limits:

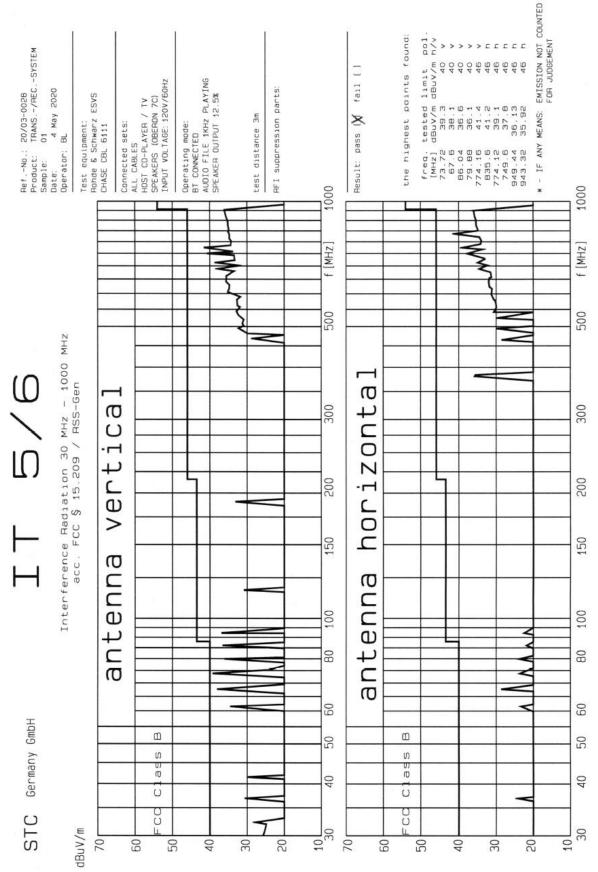
	Freq.	Measured Value @ 3m		rsion to c field ^{Note 1}	Lin @:		Margin	Result
Function	[MHz]	[dBµV/m]	[dBµA/m]	[µA/m]	[dBµA/m]	[µA/m]	[dB]	
	0.009 – 0.490	< 73.8	< 22.3	-/-	77 - 42.3	-/-	>20	pass
Bluetooth connected – Audio file 1 kHz playing	0.490 – 1.705	< 43.0	< -8.5	-/-	22.3 - 11.5	-/-	>20	pass
	1.705 - 30	< 49.5	< -2.0	-/-	18	-/-	>20	pass

Note 1: Converstion E-field to H-Field: $x [dB\mu V/m] - 51.5 = y [dB\mu A/m]$

> Converstion [dB μ A/m] in [μ A/m] 10 ^ (y [dB μ A/m] / 20) = z [μ A/m]

Result 30 MHz – 1000 MHz

As worst cases the mode No. 6. with Bluetooth connected – Audio file 1 kHz playing was found and documented in this report.



	Test report no.:	Page 24 of 105 pages
ESTC IN GERMANY	20/03-0028	Page 24 of 105 pages

Frequency [MHz]	Detector	Antenna polarization	Radiated emission [dBµV/m]	Radiated emission [µV/m]	Limit [dBµV/m] (3 m)	Limit [µV/m] (3 m)	Result
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
73.72	QP	V	39.3	92.26	40.00	100	Pass
67.6	QP	V	38.1	80.35	40.00	100	Pass
86.04	QP	V	36.6	67.61	40.00	100	Pass
79.88	QP	V	36.1	63.83	40.00	100	Pass
744.16	QP	V	41.4	117.49	46.00	200	Pass
-/-	QP	V	-/-	-/-	-/-	-/-	-/-
835.6	QP	Н	41.2	114.82	46.00	200	Pass
774.12	QP	Н	39.1	90.16	46.00	200	Pass
749.6	QP	Н	37.8	77.62	46.00	200	Pass
949.44	QP	Н	36.13	64.05	46.00	200	Pass
943.32	QP	Н	35.92	62.52	46.00	200	Pass
-/-	QP	Н	-/-	-/-	-/-	-/-	-/-

The six highest emissions for each polarization (H/V) in the frequency range 30 MHz - 1000 MHz are as following:

- (1) = test frequency
- (2) = used detector quasi peak (QP), peak, average (AV)
- (3) = polarization of the test antenna (Horizontal/Vertical)
- (4) = Reading of test receiver $[dB\mu V]$ + correction factor
- $(5) = 10^{(Radiated emission [dBµV/m] (4))/20)}$
- (6) = relevant limit in $dB\mu V/m$
- (7) = relevant limit in μ V/m
- (8) = comparison between Limit $[dB\mu V/m]$ (6) and Radiated emission $[dB\mu V/m]$ (4)

ESTC TESTED	Test report no.:	Page 25 of 105 pages
ESIC IN GERMANY	20/03-0028	Fage 25 01 105 pages

Result 1 GHz – 7 GHz

As worst cases the mode No. 9 Bluetooth single Frequency transmission at 2480 MHz 8DPSK was found and documented in this report. Additional the Audio in (RCA) – Audio file 1 kHz playing mode No.: 13 is also documented in this report.

TESTED IN GER	MANY	Interferenc	5/6 ce radiation \$ 15.209/RSS-Gen	E	ST
RefNo.:	20/03-0028				
Product:	Transmitting/F	Receiving System			
Sample:	03				
Date:	19.05.2020				
Operator:	BI				pass fa
Remarks:				Result:	
Limit Ch Line IT50	Max o 2Pk Max eck 5-1-7GHZ-PEAK-F(5-1-7CHZ-AV-FCC				
90 dBµV/m+++		-81 1'488			
IT56-1-76H7-P	EAK-FCC-BT.LIN				
70 аврули					
60 dBµV/m—					
					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
60 dBµV/m		wath hiterature	- W- MAR WARMAN MANA MANA MANA MANA MANA MANA MANA		
60 dBµV/m		with the second se		mprover and the	
60 dBµV/m		watch watch			F

	Polarisation: V								
Detector Average						Detector Peak			
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
4,9598	50,77	-3,23	54,00	pass	1-7	-/-	>20	74	pass
6,9950	39,57	-14,43	54,00	pass					
6,9233	38,95	-15,05	54,00	pass					
6,6668	38,57	-15,43	54,00	pass					
6,5333	38,49	-15,51	54,00	pass					
6,1435	37,93	-16,07	54,00	pass					

Note: Measured without Band rejection filter ID: 11243

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TESTED	IT 5/6 Interference radiation acc.FCC Subpart C § 15.209/RSS-Gen	匠STC
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Ref.-No.: 20/03-0028

Operation mode: Tx BT CH.79 (2480MHz); 8DPSK; Output power: max.

RBW (EMI) 1 MHz MT 1 s IT56-1-6GHz.TDF	_
Input 1 AC Att 0 dB Preamp OFF Step TD Scan	
Scan 91Av Max 22k Max	
Limit Check PASS Line IT56-1-7GHZ-PEAK-FCC-BT PASS	
90 dBjrWniTE6-1-7CHZ-AV-FGG-BT PA88	_
80 dBµV/m	_
T56-1-7GHZ-PEAK-FCC-BT.LIN	_
60 dBµV/m	_
T56-1-7GHZ-AV-FCC-BT.LIN	
40 dBuv/m	
40 dBµV/m 30 dBµV/m 30 dBµV/m	
30'dBµV/m	
20 dBµV/m-	-
10 dBµV/m	_
T	
Start 1.0 GHz Stop 7.0 GHz	z

	Polarisation: H											
Detector Average							Detector Peak					
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result			
4,9598	45,86	-8,14	54,00	pass	1-7	-/-	>20	74	pass			
6,9915	39,51	-14,49	54,00	pass								
6,7610	39,02	-14,98	54,00	pass								
6,6593	38,32	-15,68	54,00	pass								
6,5280	38,16	-15,84	54,00	pass								
5,9130	38,01	-15,99	54,00	pass								

Note: Measured without Band rejection filter ID: 11243

₪STC	TESTED IN GERMANY		eport no.: <b>3-0028</b>		Page 27 of 105 pages
Mode No.:13	i				
TESTED	MANY	IT 5/6 Interference ra acc. to FCC § 15.209	diation	ES	TC
RefNo.:	20/03-0028				
Product:	Transmitting/Re	ceivina System			
Sample:	01				
Date:	05.05.2020				
Operator:	BI			pass	fail
Remarks:	Host CD-Playe Input Voltage12	ected; BSF 2,4GHz co r/TV; Speakers (Obero 20V/60Hz A); Audio File 1kHz pla	on 7C);	Result: 🖂	
oporation me			rying, opoundr output	12,070	_
Spectrum	Receiver	×			
	RBW (EMI) 1 MHz M	T 1s reamp OFF Step TD Sca	IT56-1-6GHz.TDF		
Input 1 AC A		reamp or atep to sea	211		
Limit Che	ck -1-7GHZ-AV-FCC-W	PASS /LAN PASS			
	-1-76HZ-REAK-FG6				
80 dBµV/m					
IT56-1-7GHZ-PE	AK-FCC-WLAN.LIN				
60 dBµV/m					
IT56-1-7GHZ-AV	-FCC-WLAN.LIN				
00 00000			man man man have	monte and	
40 dBµV/m		a man an anna propo	Man Martin Martin		- which the start of the
annuman	Warner and and we	Molecular Contraction of the	anon have at the		
30 dBµV/m	mannent	munum			
20 dBµV/m	Alternative to redain				
10 dBµV/m					
				TF	
Start 1.0 GHz	2			Stop	p 7.0 GHz

	Polarisation: V												
Detector Average					Detector Peak								
<b>Frequ</b> . [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result				
6,9978	40,08	-13,92	54,00	pass	1-7	-/-	>20	74,00	pass				
6,9253	39,64	-14,36	54,00	pass									
6,9480	39,63	-14,37	54,00	pass									
6,8225	39,24	-14,76	54,00	pass									
6,2983	38,64	-15,36	54,00	pass									
6,5340	38,60	-15,40	54,00	pass									

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#### IT 5/6 Interference radiation acc. to FCC § 15.209 / RSS-Gen



#### Ref.-No.: 20/03-0028

Operation mode: Audio IN (RCA); Audio File 1kHz playing; Speaker output 12,5%

Spectrum Receiver (8)
RBW (EMI) 1 MHz MT 1 s IT56-1-6GHz.TDF
Input 1 AC Att 0 dB Preamp OFF Step TD Scan
Scan 🕒 1Av Max 🔁 2Pk Max
Limit Check PASS
Line IT56-1-7GHZ-AV-FCC-WLAN PASS
90 dBjty/m <del>T56-1-7CHZ-PEAK-FGG-WLAP PA88</del>
80 dBµV/m
T56-1-7GHZ-PEAK-FCC-WLAN.LIN
/o uspo/mi-
60 dBµV/m
T56-1-7GHZ-AV-FCC-WLAN.LIN
So appoint
40 dBuV/m
40 dBµV/m-
to and all all the second se
30 dBµV/m
Alter Manuna Manuna
20 dBµV/m-
10 dBµV/m
TF
Start 1.0 GHz Stop 7.0 GH

	Polarisation: H												
Detector Average						Detector Peak							
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result				
6,9965	39,41	-14,59	54,00	pass	1-7	-/-	>20	74,00	pass				
6,8103	38,92	-15,08	54,00	pass									
6,5313	38,21	-15,79	54,00	pass									
6,3043	38,10	-15,90	54,00	pass									
6,1378	37,75	-16,25	54,00	pass									
6,1023	37,67	-16,33	54,00	pass									

#### Result 7GHz – 40GHz

All emissions in the frequency range 7 GHz – 40 GHz are at least 20 dB below the relevant limit

#### Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Radiated Emissions**.



## 7. Operation within the band 902-928 MHz, 2400-2483,5 MHz and 5725-5850 MHz

#### Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 -RSS-247 issue 2

#### 7.1. 20 dB Spectrum Bandwidth Measurement

#### **Applied standards**

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (a) (1) -RSS-247 issue 2 Section 5.1 (a)

#### Limit

The minimum 20 dB bandwidth shall be at least 25 kHz.

#### Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report. Test setup used for conducted measurements as given in clause Test setups of this report.

#### Description

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

The Measurement was performed on: 12.05.2020 and 13.05.2020

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### Test report no.: 20/03-0028

Page 30 of 105 pages

#### **Lowest Operating Frequency - GFSK**



#### Middle Operating Frequency - GFSK

MultiView	Spectrum	🖾 Spe	ectrum 2	🖾 Spectr	'um 3 🛛 🛛	3			
Ref Level 20.00			• RBW 10 kHz						
Att 3 1 Frequency Swe		19 µs (~8.2 ms)	VBW 30 kHz	Mode Auto F	FT				1Pk Max
I Hequency Swe	.ep							D3[1]	-0.01 dB
								bolil	939.10 kHz
10 dBm								M1[1]	0.71 dBm
									44088760 GHz
				M1					
0 dBm			Λ	www	MA				
-10 dBm			na N	v V	N N M				
		M2	M		A	<b>№</b> 23			
-20 dBm-	-19.290 dBm	D of M				WW			
		Jury				w Ww			
-30 dBm		ww		8	12	<u> </u>	AAA		
	N						WW		
-40 dBm							6	which	
-50 dBm	$\mathcal{V}$						v	1 V	1
									Mann
-60 dBm									
CF 2.441 GHz			1001 pts		21	50.0 kHz/			Span 2.5 MHz
2 Marker Table			1001 pt	3	23				span 2.5 MHZ
Type   Ref	Trc	X-Value	1	Y-Value		Function		Function R	esult
M1	1 2.	4408876 GH		0.71 dBm					
M2 D3 M2	1 <b>2.</b>	4404306 GH 939.1 kH	iz -1 iz	L9.27 dBm -0.01 dB					
Channel	Freque	ency [MHz]		20 dB Ban	dwidth [kH	z]	Limit [kŀ	lz]	Result
39	2	2441		9	39.1		25		Pass

ESTC IN GERMANY	Test report no.: <b>20/03-0028</b>	Page 31 of 105 pages
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#### **Highest Operating Frequency - GFSK**



#### Lowest Operating Frequency - π/4 DQPSK

MultiView 8	Spectrum	Spect	trum 2 🔌	🖾 Spectr	um 3 🛛 🔆 🖾	)			
Ref Level 20.00			RBW 10 kHz						
Att 3	0 dB SWT 419	9 µs (~8.2 ms)	VBW 30 kHz	Mode Auto Fi	-Ť				
1 Frequency Swe	еер								1Pk Max
								D3[1]	-0.08 dB
872 323									1.31370 MHz
10 dBm								M1[1]	0.80 dBm-
				M1				2.	40189010 GHz
0 dBm	6			8.					
		And	mart	mm	MMM	han.			
-10 dBm		00	W V	* V	V V	NAM			
		MW				h	My A3		
-20 dBm	-19.200 dBm - / V	4					Va		
	M								
-30 dBm									
	my N						Long	n	2
-40 dBm	W							Man	hmm
V_50 dBm		12				ss			YrY
-60 dBm									
CF 2.402 GHz			1001 pts		25	0.0 kHz/	3		Span 2.5 MHz
2 Marker Table			1001 000		20				
Type   Ref	Trc	X-Value		Y-Value		Function		Function Re	sult
M1	1 2.4	018901 GHz		0.80 dBm		And below to be a second			
M2 D3 M2	1 <b>2.4</b>	012458 GHz 1.3137 MHz	-1	9.13 dBm -0.08 dB					
Channel	Frequer	ncy [MHz]			dwidth [kHz	2]	Limit [kHz]	1 F	Result
0	-	402			13.7		25	-	Pass
5	24	102		13	13.7		25		a33

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## Test report no.: 20/03-0028

Page 32 of 105 pages

#### Middle Operating Frequency - $\pi/4$ DQPSK

MultiView	Spectrum	🖾 Spee	trum 2	🗵 Spectr	rum 3 🛛 🖾	D			
Ref Level 20.00 Att		419 μs (~8.2 ms)	RBW 10 kHz VBW 30 kHz		=7				1028
1 Frequency Sw		+19 µs (~o.2 ms)	VBW JUKH2	. Mode Auto P					1Pk Max
I Trequency of	eep							M2[1]	-19.41 dBm
									44024330 GHz
10 dBm								M1[1]	0.61 dBm
				M1					44088760 GHz
0 dBm			0						
20 Juli		, man	man	mm	mm	Wahan			
-10 dBm	м	e. MW		W.	n di sila	war	A 93		
-20 dBm	-19.390 dBm 🕂	WY					14		
	h						2		
-30 dBm	my M					2	Lan	η	2
-40 dBm	V						~~~	Marin	howhow
-50 dBm									
-60 dBm									
CF 2.441 GHz			1001 pt	6	25	0.0 kHz/	3		Span 2.5 MHz
2 Marker Table									
Type Ref	Trc	X-Value		Y-Value	1	Function		Function Re	esult
M1 M2 D3 M2		.4408876 GH .4402433 GH 1.3137 MH	z -1	0.61 dBm L9.41 dBm 0.74 dB					
Channel	Freque	ency [MHz]		20 dB Ban	dwidth [kHz	z]	Limit [kHz	:] F	Result
39		2441		13	313.7		25		Pass

#### Highest Operating Frequency - π/4 DQPSK

MultiView	Spectrum	Spec	trum 2	Spectr	um 3 🛛 🖾	Ĵ			$\bigtriangledown$
Ref Level 20.00			RBW 10 kHz		<u></u>	2. <del>3</del>			1-226 225
Att 3 1 Frequency Swe	BO dB SWT 41	19 µs (~8.2 ms)	VBW 30 kHz	Mode Auto Ff					1Pk Max
I Trequency our								D3[1]	0.92 dB
								DOLAT	1.31120 MHz
10 dBm								-M1[1]-	0.61 dBm-
									47988510 GHz
				M1					
0 dBm		0.0 m	mach	MM	mm	h nh n			
-10 dBm	0	al V Mar	WY	W I		"V "hanft			
	M2	M		Sex 14		ch	~ ⁸³		
-20 dBm-	-19/390 aBm ///						M		
	M						6		
-30 dBm									
	my M						Lam	٨	
-40 dBm	W				20			Marin	hmmy
									у <b>у</b>
-60 dBm									
05.0.40.011			1001			0.0111.4			0.051411
CF 2.48 GHz			1001 pts		25	0.0 kHz/			Span 2.5 MHz
2 Marker Table Type   Ref	Trc	X-Value	Ĩ	Y-Value	r	Function	[	-unction Re	scult
M1	1 2.4	4798851 GHz		0.61 dBm		rancuon		unction Re	Jour
M2 D3 M2		4792433 GHz 1.3112 MHz	-18	8.96 dBm 0.92 dB					
Channel	Freque	ncy [MHz]			dwidth [kHz	ː]	Limit [kHz]	F	lesult
79	2	2480			11.2		25		Pass

## Test report no.: 20/03-0028

Page 33 of 105 pages

#### **Lowest Operating Frequency - 8DPSK**

MultiView 😁	Spectrum	x s	Spectrum 2	🖾 Specti	rum 3 🛛 🖾	D		
Ref Level 20.00			• RBW 10 kH					
Att 3 1 Frequency Swe		19 µs (~8.2 r	ns) <b>VBW</b> 30 kH	z Mode Auto F	Tel.			1Pk Max
I Trequency out	eep							M2[1] -19.10 dBr
								2.40124330 GH
10 dBm		-						
				M1				2.40189010 GH
0 dBm		á		1 An	Λ			
10 -0		M	mm	mm	when	mm		
-10 dBm	M	ennin	No. 8			hy	A3	
-20 dBm	19.280 dBm 🚽	ļ '					hy	
	~						h	
-30 dBm	00					2	1 Mm	
-40 dBm -	" Vly	-			6			mm Amana
m ~ m							ľ	mont
-50 dBm					~			
-60 dBm		-			C			
CF 2.402 GHz			1001 pt	IS IS	25	0.0 kHz/		Span 2.5 MH
2 Marker Table								
Type Ref	Trc	X-Value		Y-Value		Function	F	unction Result
M1 M2 D3 M2		4018901 4012433 1.2862	GHz -	0.72 dBm 19.10 dBm 0.64 dB				
Channel	Freque	ency [MHz	<u>2]</u>	20 dB Ban	dwidth [kHz	z]	Limit [kHz]	Result
0	2402			1286.2			25	Pass

#### Middle Operating Frequency - 8DPSK

MultiView 8	Spectrum		trum 2	🖾 Spectr	um 3 🛛 🖾				
Ref Level 20.00	) dBm		RBW 10 kHz						
		419 µs (~8.2 ms)	VBW 30 kHz	Mode Auto F	-1 -				
1 Frequency Sw	еер							1.100 5 1.7	1Pk Max
								M2[1]	-19.36 dBm
									44023830 GHz
10 dBm						10		M1[1]	0.73 dBm
				M1				Ζ.	44088760 GHz
0 dBm				Å	A				
		m	mm	mm	Man	marching			
-10 dBm		John .	. m		V V*	1 mpr h			
	M	mm							
-20 dBm	1 -19.270 dBm 🚽					Y	VB3		
20 0011	1	-					- 4		
	d						N		
-30 dBm					32	21			
0.00	mal						L.M.M.	M and A	
M dBm	Var /*							Lun M.	vann
-50 dBm				×.		a			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
00 4011									
-60 dBm									
CF 2.441 GHz			1001 pt	S	25	50.0 kHz/			Span 2.5 MHz
2 Marker Table	[ <b>-</b> [		1						
Type Ref	Trc	X-Value .4408876 GH:	7	Y-Value 0.73 dBm		Function		Function Re	esuit
M2		.4402383 GH		L9.36 dBm					
D3 M2	i –	1.2912 MH	z	0.13 dB					
Channel	Freque	ency [MHz]		20 dB Ban	dwidth [kH		Limit [kHz]	] F	Result
39				1291.2			25		Pass

ESTC TESTED IN GERMANY	Test report no.: <b>20/03-0028</b>	Page 34 of 105 pages
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#### **Highest Operating Frequency - 8DPSK**



#### Results

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **20 dB Bandwidth**.