TEST REPORT

of

RE Directive (2014/53/EU)
ETSI EN 300 328 v2.2.2

Product:	**Bluetooth 5.2 Module**
Brand:	**Fanstel**
Model:	**BM840; BM840P**
Model Difference:	**Antenna difference**
Applicant:	**Fanstel Corporation, Taipei**
Address:	**10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi-Chih, New Taipei City 221 Taiwan**

Test Performed by:

International Standards Laboratory Corp. LT Lab.
TEL: +886-3-263-8888 FAX: +886-3-263-8899
No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

Report No.: **ISL-22LR0022E328**
Issue Date :**2022/02/09**

Testing Laboratory
0997

VERIFICATION OF COMPLIANCE

Applicant:	Fanstel Corporation, Taipei
Equipment Under Test:	Bluetooth 5.2 Module
Brand Name:	Fanstel
Model Number:	BM840; BM840P
Model Different:	Antenna difference
Date of Test:	2022/01/18 ~ 2022/02/08
Date of EUT Received:	2022/01/18

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
ETSI EN 300 328 V2.2.2	Complied

The above equipment was tested by International Standards Laboratory Corp. for compliance with the requirements set forth in the European Standard ETSI EN 300 328 V2.2.2. under article 3.2 of RE Directive 2014/53/EU. The results of testing in this report apply to the product/system that was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Test By:	Weitin Chen	***Date:***	2022/02/09
	Weitin Chen / Senior Engineer		
Prepared By:	Gigi yeh	***Date:***	2022/02/09
	Gigi Yeh / Senior Engineer		
Approved By:	Jerry Liu	***Date:***	2022/02/09
	Jerry Liu / Assistant Manager		

Version

Version No.	Date	Description
00	2022/02/09	Initial creation of document

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1. Description of Equipment under Test (EUT)

General:

Product Name:	Bluetooth 5.2 Module
Brand Name:	Fanstel
Model Name:	BM840; BM840P
Model Difference:	Antenna difference
Type of Equipment:	Stand-alone equipment
Temperature Range:	-40°C to +105°C
Simultaneous transmissions:	Yes
Geo-location capability:	No
Power Supply	5Vdc from USB (JIG)

Model Summaries:

module	BM840	BM840P
Flash/RAM	1MB/256KB	1MB/256KB
Size	10.2x15x1.9mm	10.2x15x1.9mm
GPIO	32	32
Antenna	PCB Trace	Pads for external

Bluetooth Version	BT 5.2
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	Wide band Modulation
Transmit Power (EIRP):	8.94 dBm
Dwell Time	N/A
Operating Mode	Point-to-Point
Adaptive/ Non-Adaptive	Non-Adaptive
LBT (Listen Before Talk)	Yes
	■ Adaptive Frequency Hopping using LBT based DAA ☐ Adaptive Frequency Hopping using other forms of DAA (non-LBT based) ☐ Short Control Signaling Transmissions
Occupied Channel Bandwidth	Within 2400-2483.5MHz
Duty Cycle	N/A
Antenna Beam forming	No
Antenna Designation:	BM840 : PCB Antenna, 1.54 dBi (Max) BM840P : Dipole Antenna, 0 dBi

This test report applies for Bluetooth BLE

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

2. Description of Test Modes

The EUT has been tested under Operating condition. To control the EUT for staying in continuous transmitting and receiving mode is programmed.

BLE: Lowest (2402MHz), Mid (2442MHz) and Highest (2480MHz) mode.

Normal test conditions :
Refer to section 5.1.1.2 of EN 300 328
Temperature : -20℃ to 55 ℃
Relative humidity: 20 % to 75 %

Normal Voltage: 5Vdc

Extreme test conditions :
Refer to section 5.1.1.3 of EN 300 328

Where tests at extreme temperatures are required, measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer.

Extreme temperatures: -40°C ~ 105°C

3. General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

ETSI EN 300 328 V2.2.2 – Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band; Harmonized Standard for access to radio spectrum

4. Test Facility

International Standards Laboratory Corp.
<LT Lab.>
No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

A fully anechoic chamber was used for the radiated spurious emissions test.

5. Block Diagram of Test Setup

5.1 EUT Configuration

Fig. 1 Configuration of Tested System

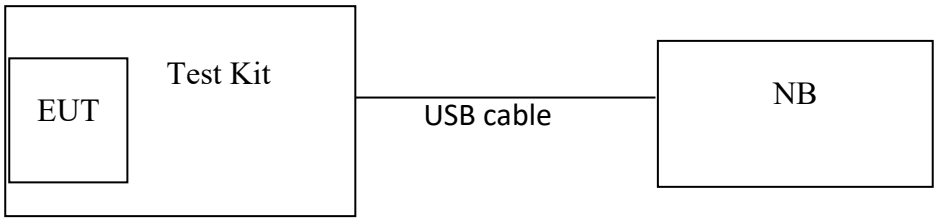


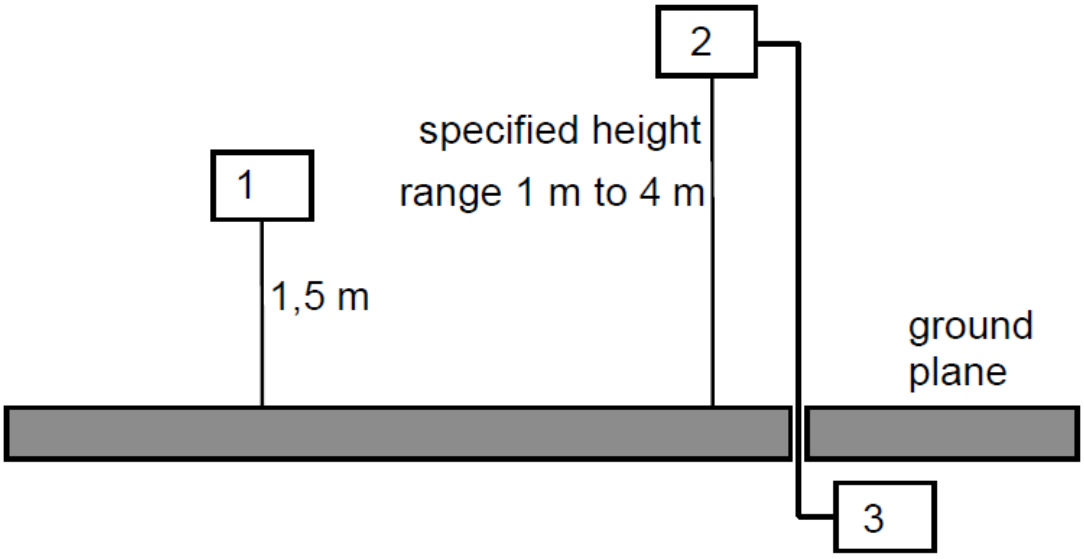
Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	Notebook	Lenovo	X220i	N/A	N/A	Non-shielded
2	Test Kit	N/A	N/A	N/A	N/A	N/A

5.2 Test Setup for ERP/EIRP Measurement

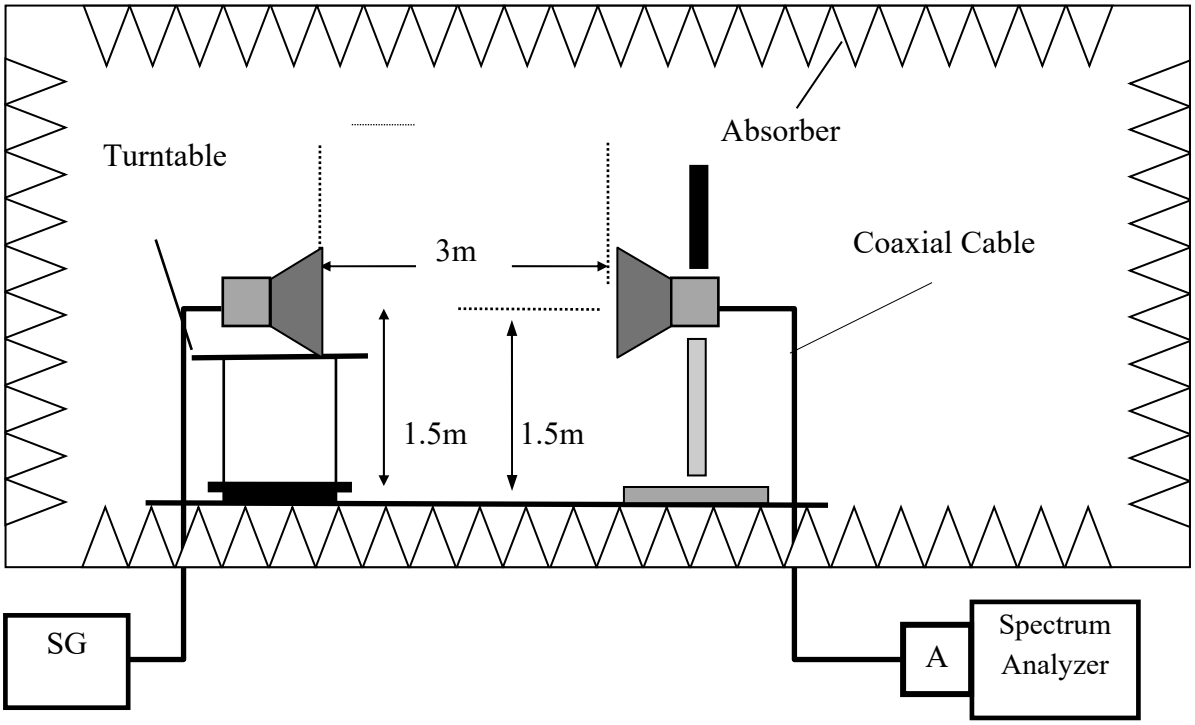
5.2.1 Step 1. Field Strength Measurement

OATS or SAR test Site

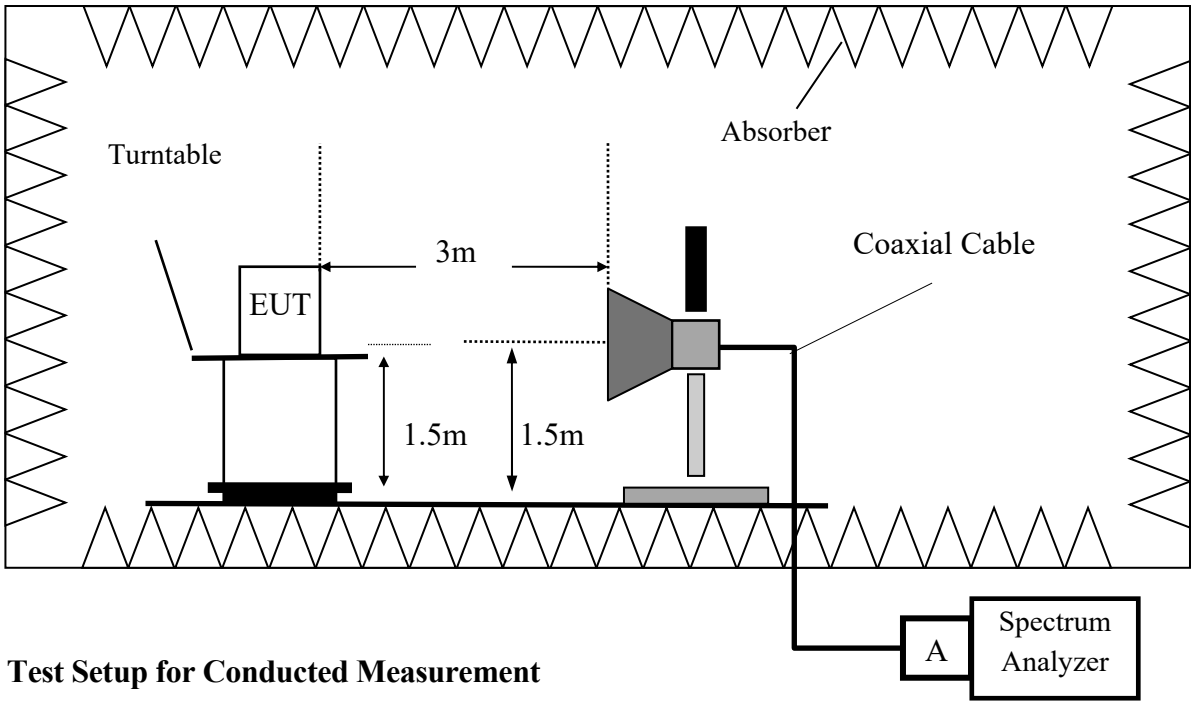


1) UUT
2) Measurement antenna
3) Measurement equipment

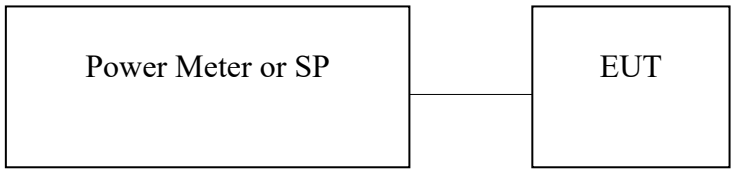
FAR Test Site



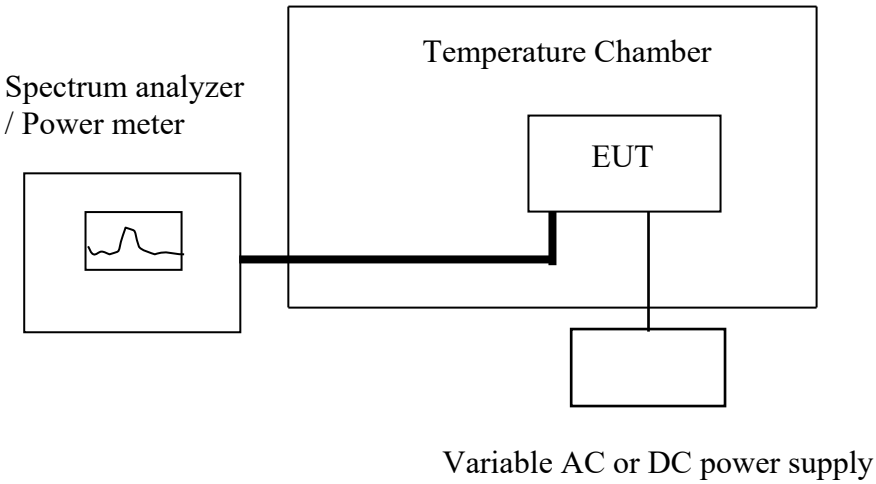
Step 2. SUBSTITUTION METHOD:



5.3 Test Setup for Conducted Measurement



5.4 Test Setup for Extreme test



5.5 Test Setup for verifying the adaptivity of an equipment

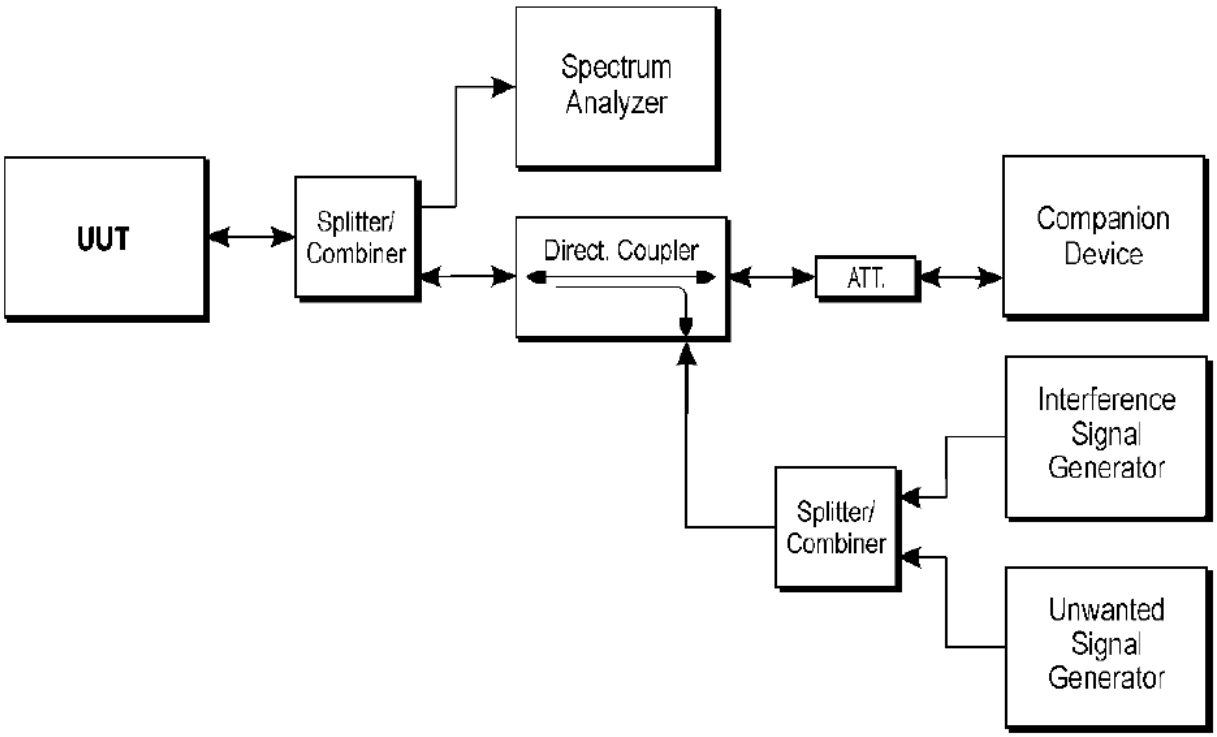


Figure 5: Test set-up for verifying the adaptivity of an equipment

5.6 Test Setup for verifying the receiver blocking of an equipment

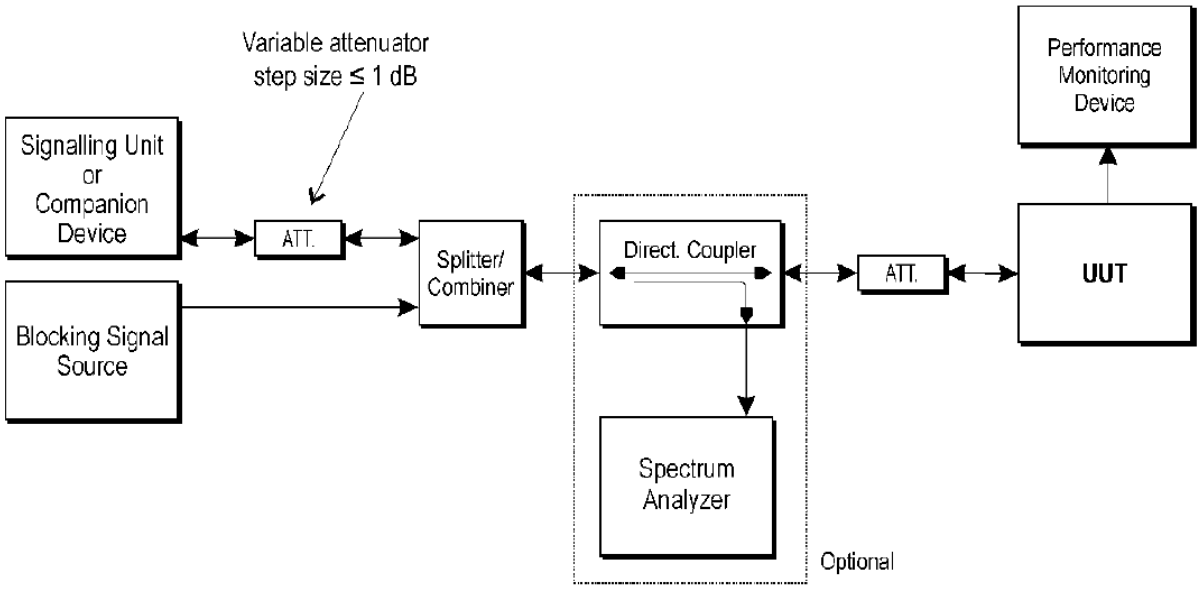


Figure 6: Test Set-up for receiver blocking

5.7 Measurement Equipment Used:

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 16	Spectrum Analyzer (26.5GHz)	Agilent	N9010A	MY52100117	09/01/2021	09/01/2022
Chamber 16	Dipole antenna	Schwarzbeck	VHAP,30-300	919	05/13/2021	05/13/2022
Chamber 16	Dipole antenna	Schwarzbeck	UHAP,300-1000	1195	05/13/2021	05/13/2022
Chamber 16	Loop Antenna	EM	EM-6879	271	09/29/2021	09/29/2022
Chamber 16	Bilog Antenna	Schwarzbeck	VULB9168 w 5dB Att.	9168-495	11/11/2021	11/11/2022
Chamber 16	Horn antenna (1GHz - 18GHz)	EM	EM-AH-10180	2011071401	11/25/2021	11/25/2022
Chamber 16	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/30/2021	11/30/2022
Chamber 16	Horn antenna (26GHz - 40GHz)	Com-power	AH-640	100A	03/11/2021	03/11/2022
Chamber 16	Preamplifier (9kHz - 3GHz)	EM	EM330	060822	12/22/2021	12/22/2022
Chamber 16	Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060559	05/20/2021	05/20/2022
Chamber 16	Preamplifier (26GHz - 40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/07/2021	05/07/2022
Chamber 16	Cable (100kHz-1GHz)	HUBER SUHNER	Sucoflex 104A	1166 cable 001	12/28/2021	12/28/2022
Chamber 16	Cable (9kHz-18GHz)	HUBER SUHNER	Sucoflex 104A	1166 cable 002	12/23/2021	12/23/2022
Chamber 16	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	11/17/2021	11/17/2022
Chamber 16	Signal Generator	Anritsu	MG3692A	20311	12/28/2021	12/28/2022
Chamber 16	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

Location Conducted	EQUIPMENT NAME	BRAND	MODEL	S/N	Last Cal. Date	Next Cal. Date
Conducted	POWER METER	ANRITSU	ML2495A	1116010	09/30/2021	09/30/2022
Conducted	POWER SENSOR	ANRITSU	MA2411B	34NKF50	09/30/2021	09/30/2022
Conducted	POWER SENSOR	DARE	RPR3006W	13I00030SNO33	01/07/2022	01/07/2023
Conducted	POWER SENSOR	DARE	RPR3006W	13I00030SNO34	01/07/2022	01/07/2023
Conducted	POWER SENSOR	DARE	RPR3006W	14I00889SNO35	06/23/2021	06/23/2022
Conducted	POWER SENSOR	DARE	RPR3006W	14I00889SNO36	06/23/2021	06/23/2022
Conducted	TEMPERATURE CHAMBER	KSON	THS-B4H100	2287	04/26/2021	04/26/2022
Conducted	DC Power supply	ABM	8185D	N/A	01/06/2022	01/06/2023
Conducted	AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/28/2021	09/28/2022
Conducted	Test Software	DARE	Radiation Ver:2013.1.23	NA	NA	NA
Conducted	TEST SOFTWARE	R&S	CMUGO VER:2.0.0	N/A	N/A	N/A
Conducted	UNIVERSAL DIGITAL RADIO COMMUNICATION TESTER	R&S	CMU200	111968	11/18/2021	11/18/2022
Conducted	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW500	1201.002K50108793-JG	10/26/2021	10/26/2022
Conducted	BT Simulator	Agilent	N4010A	MY48100200	NA	NA
Conducted	GPS SIMULATOR	WELNAVIGATE	GS-50	701523	NA	NA
Conducted (TS8997)	Wideband Radio Communication Tester	R&S	CMW500	168811	09/09/2021	09/09/2022
Conducted (TS8997)	Signal Generator	R&S	SMB100B	101085	09/09/2021	09/09/2022
Conducted (TS8997)	Vector Signal Generator	R&S	SMBV100A	263246	09/09/2021	09/09/2022
Conducted (TS8997)	Signal analyzer 40GHz	R&S	FSV40	101884	09/07/2021	09/07/2022
Conducted (TS8997)	OSP150 extension unit CAM-BUS	R&S	OSP150	101107	09/10/2021	09/10/2022
Conducted (TS8997)	Test Software	R&S	EMC32 Ver:11.10.00	NA	NA	NA

6. Other Types of Wide Band Modulation Equipment

6.1 ETSI EN 300 328 SUB-CLAUSE 4.3.2.2 RF Output Power

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.1.1 Limit: Sub-Clause 4.3.2.2.3

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.

The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. See clause 5.3.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.

This limit shall apply for any combination of power level and intended antenna assembly.

6.1.2 Test Procedure:

See Sub-Clause 5.4.2.1 of ETSI EN 300 328 for the test conditions
See Sub-Clause 5.4.2.2 of ETSI EN 300 328 for the test method

6.1.3 Test Result :

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

Mode	Frequency (MHz)	Temp.	Output Power e.i.r.p. (dBm)	Limit (dBm)	Results
BLE	2402	Normal	7.24	20	Pass
		Low	8.34	20	Pass
		High	7.34	20	Pass
	2442	Normal	7.54	20	Pass
		Low	8.64	20	Pass
		High	7.54	20	Pass
	2480	Normal	7.84	20	Pass
		Low	8.94	20	Pass
		High	7.94	20	Pass

6.2 ETSI EN 300 328 SUB-CLAUSE 4.3.2.3 Power Spectral Density

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.1.1 Limit: Sub-Clause 4.3.2.3.3

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

6.2.1 Test Procedure:

See Sub-Clause 5.4.3.1 of ETSI EN 300 328 for the test conditions
See Sub-Clause 5.4.3.2 of ETSI EN 300 328 for the test method

6.2.2 Test Result:

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

Mode	Frequency (MHz)	PSD e.i.r.p. (dBm/MHz)	Limit (dBm/MHz)	Results
BLE	2412	9.00	10	Pass
	2437	8.66	10	Pass
	2472	7.46	10	Pass

6.3 ETSI EN 300 328 SUB-CLAUSE 4.3.2.4 Duty Cycle, Tx-sequence, Tx-gap

These requirements apply to non-adaptive equipment or to adaptive equipment when operating in a non-adaptive mode.

The equipment is using wide band modulations other than FHSS.
These requirements do not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

6.3.1 Limit: Sub-Clause 4.3.2.4.3

The Duty Cycle shall be equal to or less than the maximum value declared by the supplier.

The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.

6.3.2 Test Procedure:

See Sub-Clause 5.4.2.1 of ETSI EN 300 328 for the test conditions
See Sub-Clause 5.4.2.2 of ETSI EN 300 328 for conducted method.

6.3.3 Test Result:

N/A, this is adaptive device without non-adaptive mode.

6.4 ETSI EN 300 328 SUB-CLAUSE 4.3.2.5 Medium Utilization (MU) factor

This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

6.4.1 Limit: Sub-Clause 4.3.2.5.3

For non-adaptive equipment using wide band modulations other than FHSS, the maximum Medium Utilisation factor shall be 10 %.

The Medium Utilisation (MU) factor is a measure to quantify the amount of resources (Power and Time) used by non-adaptive equipment. The Medium Utilisation factor is defined by the formula:

MU = (P/100 mW) × DC,

where: MU is Medium Utilisation factor in %.

P is the RF output power as defined in clause 4.3.1.1.1 expressed in mW.

DC is the Duty Cycle as defined in clause 4.3.1.2.1 expressed in %.

6.4.2 Test Procedure:

See Sub-Clause 5.4.5.1 of ETSI EN 300 328 for the test conditions
See Sub-Clause 5.4.5.2 of ETSI EN 300 328 for conducted method.

6.4.3 Test Result:

N/A, this is adaptive device without non-adaptive mode.

6.5 ETSI EN 300 328 SUB-CLAUSE 4.3.2.6 Adaptivity (Adaptive Equipment Using Modulations Other Than FHSS)

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

Adaptive equipment using modulations other than FHSS is allowed to operate in a non-adaptive mode providing it complies with the requirements applicable to non-adaptive equipment.

An adaptive equipment using modulations other than FHSS is equipment that uses a mechanism by which it can adapt to its radio environment by identifying other transmissions present within its Occupied Channel Bandwidth.

Adaptive equipment using modulations other than FHSS shall implement either of the Detect and Avoid mechanisms provided in clause 4.3.2.6.2 or clause 4.3.2.6.3.

Adaptive equipment is allowed to switch dynamically between different adaptive modes.

6.5.1 Requirements & Limit:

Frame Based Equipment: refer to ETSI EN 300 328 SUB-CLAUSE 4.3.2.6.2.2 Requirements & Limits

$$TL = -70\ \text{dBm/MHz} + 10 \times \log_{10}(100\ \text{mW} / \text{Pout}) \qquad (\text{Pout in mW e.i.r.p.})$$

Table 7: Unwanted Signal parameters

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2395 or 2488.5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2400 MHz to 2442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2442 MHz to 2483.5 MHz. See clause 5.4.6.1. NOTE 2: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

Load Based Equipment: refer to ETSI EN 300 328 SUB-CLAUSE 4.3.2.6.3.2.3 Requirements & Limits

$$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / Pout) \qquad (Pout\ in\ mW\ e.i.r.p.)$$

Table 8: Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2395 or 2488.5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2400 MHz to 2442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2442 MHz to 2483.5 MHz. See clause 5.4.6.1. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

Short Control Signaling Transmissions: refer to ETSI EN 300 328 SUB-CLAUSE 4.3.2.6.4 Limits

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than
FHSS shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.
NOTE: Duty Cycle is defined in clause 4.3.2.4.2.

6.5.2 Test Procedure:

See Sub-Clause 5.4.6.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.6.2 of ETSI EN 300 328 for conducted method.

6.5.3 Test Result:

N/A, the RF output power is less than 10 dBm e.i.r.p.

6.6 ETSI EN 300 328 SUB-CLAUSE 4.3.2.7 Occupied Channel Bandwidth

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.6.1 Limit: Sub-Clause 4.3.2.7.3

The Occupied Channel Bandwidth shall fall completely within the band given in clause 1.

In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

6.6.2 Test Procedure:

See Sub-Clause 5.4.7.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.7.2 of ETSI EN 300 328 for conducted method.

6.6.3 Test Result :

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

Test Mode: BT LE

Occupied Channel Bandwidth		
	Channel Low	**Channel High**
Occupied Bandwidth (MHz)	1.08	1.08
Lowest/Highest Frequency (MHz)	2401.4664	2480.5483
Limit (Operating in the band)	2400~2483.5MHz	2400~2483.5MHz
Measurement Uncertainty	+/- 120kHz	

6.7 ETSI EN 300 328 SUB-CLAUSE 4.3.2.8 Transmitter Unwanted Emissions in the out-of-band Domain

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.7.1 Limit: Sub-Clause 4.3.2.8.3

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 2.

Within the band specified in table 1, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.7.

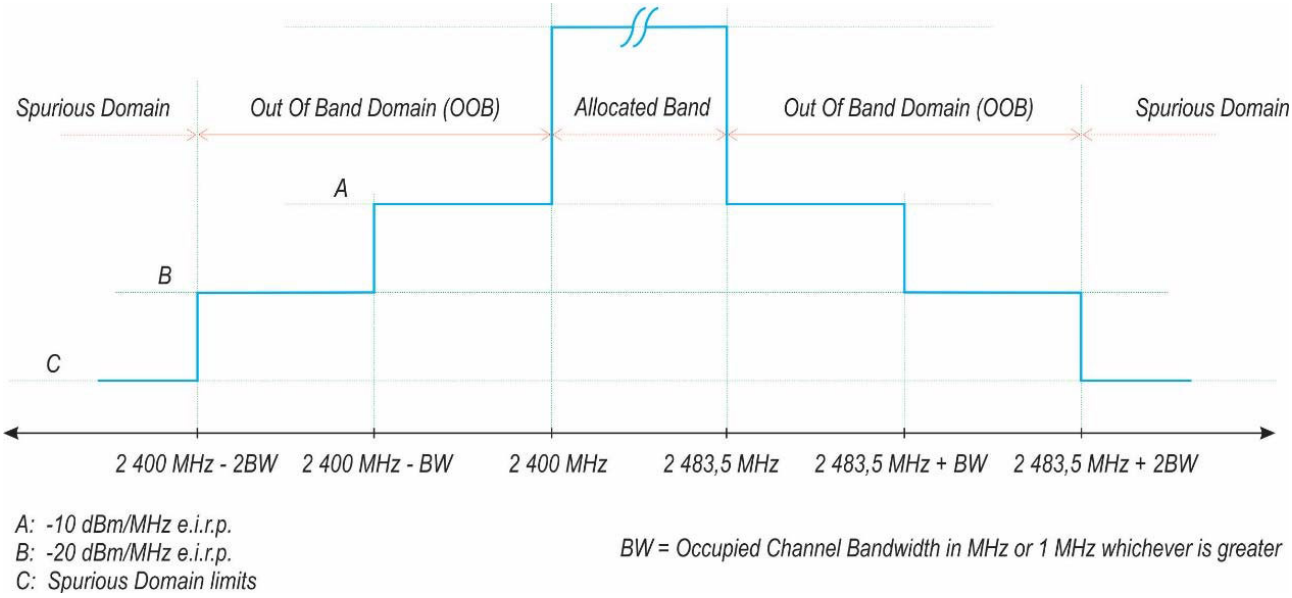


Figure 2: Transmit mask

6.7.2 Test Procedure:

Conducted test method

See Sub-Clause 5.4.8.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.8.2 of ETSI EN 300 328 for conducted method.

6.7.3 Test Result:

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

Out of Band Domain Emission				
Test condition	2400-BW ~ 2400-2BW	2400 ~ 2400-BW	2483.5 ~ 2483.5+BW	2483.5+BW ~ 2483.5+2BW
2402MHz	-32.11	-40.57	-34.12	-44.51
2442MHz	-31.19	-41.28	-33.27	-44.28
2480MHz	-33.28	-43.61	-31.54	-44.66
Limit(dBm/MHz)	**-20**	**-10**	**-10**	**-20**

6.8 ETSI EN 300 328 SUB-CLAUSE 4.3.2.9 Transmitter Unwanted Emissions in the Spurious Domain

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.8.1 Limit: Sub-Clause 4.3.2.9.3

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 9.

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 9: Transmitter limits for spurious emissions

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

6.8.2 Test Procedure:

See Sub-Clause 5.4.9.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.9.2 and 5.4.9.2.2 of ETSI EN 300 328 for Conducted Pre-Scan test method.

See Sub-Clause 5.4.9.2.2 of ETSI EN 300 328 for final Radiated test method.

6.8.3 Test Result:

Model: BM840 (PIFA Ant.)

Test Mode: BLE mode, TX CH Low

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	84.75	-52.62	1.00	-51.62	-36.00	-15.62	VERTICAL
2	192.67	-63.50	2.23	-61.27	-54.00	-7.27	VERTICAL
3	504.45	-73.61	8.95	-64.66	-54.00	-10.66	VERTICAL
4	615.48	-74.83	10.73	-64.10	-54.00	-10.10	VERTICAL
5	743.48	-78.71	13.73	-64.98	-36.00	-28.98	VERTICAL
6	813.98	-75.38	13.83	-61.55	-36.00	-25.55	VERTICAL
7	1553.38	-63.56	2.18	-61.38	-30.00	-31.38	VERTICAL
8	4804.00	-72.44	15.71	-56.73	-30.00	-26.73	VERTICAL
1	85.18	-53.42	0.37	-53.05	-36.00	-17.05	HORIZONTAL
2	192.47	-58.12	1.70	-56.42	-54.00	-2.42	HORIZONTAL
3	594.92	-75.05	11.10	-63.95	-54.00	-9.95	HORIZONTAL
4	665.37	-76.63	11.93	-64.70	-54.00	-10.70	HORIZONTAL
5	740.47	-76.41	13.94	-62.47	-36.00	-26.47	HORIZONTAL
6	814.30	-77.24	14.39	-62.85	-36.00	-26.85	HORIZONTAL
7	1441.29	-63.36	2.16	-61.20	-30.00	-31.20	HORIZONTAL
8	4804.00	-73.23	15.63	-57.60	-30.00	-27.60	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: BLE mode, TX CH High

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	84.82	-48.17	1.00	-47.17	-36.00	-11.17	VERTICAL
2	192.45	-61.97	2.23	-59.74	-54.00	-5.74	VERTICAL
3	481.05	-72.41	8.99	-63.42	-54.00	-9.42	VERTICAL
4	591.97	-72.77	9.94	-62.83	-54.00	-8.83	VERTICAL
5	741.04	-79.23	13.74	-65.49	-36.00	-29.49	VERTICAL
6	814.50	-74.84	13.83	-61.01	-36.00	-25.01	VERTICAL
7	1994.55	-62.50	4.60	-57.90	-30.00	-27.90	VERTICAL
8	4960.00	-72.74	16.40	-56.34	-30.00	-26.34	VERTICAL
1	84.99	-50.26	0.37	-49.89	-36.00	-13.89	HORIZONTAL
2	192.02	-56.80	1.70	-55.10	-54.00	-1.10	HORIZONTAL
3	594.99	-78.11	11.10	-67.01	-54.00	-13.01	HORIZONTAL
4	666.15	-78.25	11.93	-66.32	-54.00	-12.32	HORIZONTAL
5	743.15	-78.90	14.04	-64.86	-36.00	-28.86	HORIZONTAL
6	816.91	-76.40	14.44	-61.96	-36.00	-25.96	HORIZONTAL
7	1994.85	-63.53	4.75	-58.78	-30.00	-28.78	HORIZONTAL
8	4960.00	-72.17	16.15	-56.02	-30.00	-26.02	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Model: BM840P (Dipole Ant.)

Test Mode: BLE mode, TX CH Low

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.29	-51.77	1.00	-50.77	-36.00	-14.77	VERTICAL
2	192.38	-61.75	2.23	-59.52	-54.00	-5.52	VERTICAL
3	505.18	-72.82	8.95	-63.87	-54.00	-9.87	VERTICAL
4	615.89	-74.50	10.73	-63.77	-54.00	-9.77	VERTICAL
5	744.29	-76.70	13.73	-62.97	-36.00	-26.97	VERTICAL
6	815.89	-74.61	13.83	-60.78	-36.00	-24.78	VERTICAL
7	1554.49	-62.81	2.18	-60.63	-30.00	-30.63	VERTICAL
8	4804.00	-71.34	15.71	-55.63	-30.00	-25.63	VERTICAL
1	85.62	-52.15	0.37	-51.78	-36.00	-15.78	HORIZONTAL
2	194.21	-56.58	1.70	-54.88	-54.00	-0.88	HORIZONTAL
3	596.79	-74.42	11.10	-63.32	-54.00	-9.32	HORIZONTAL
4	666.93	-74.86	11.93	-62.93	-54.00	-8.93	HORIZONTAL
5	742.29	-76.35	13.94	-62.41	-36.00	-26.41	HORIZONTAL
6	815.06	-76.83	14.39	-62.44	-36.00	-26.44	HORIZONTAL
7	1442.71	-62.05	2.16	-59.89	-30.00	-29.89	HORIZONTAL
8	4804.00	-72.67	15.63	-57.04	-30.00	-27.04	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: BLE mode, TX CH High

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.96	-47.23	1.00	-46.23	-36.00	-10.23	VERTICAL
2	193.54	-61.72	2.23	-59.49	-54.00	-5.49	VERTICAL
3	481.06	-71.11	8.99	-62.12	-54.00	-8.12	VERTICAL
4	593.45	-71.18	9.94	-61.24	-54.00	-7.24	VERTICAL
5	742.94	-77.90	13.74	-64.16	-36.00	-28.16	VERTICAL
6	816.03	-74.37	13.83	-60.54	-36.00	-24.54	VERTICAL
7	1995.55	-61.50	4.60	-56.90	-30.00	-26.90	VERTICAL
8	4960.00	-71.46	16.40	-55.06	-30.00	-25.06	VERTICAL
1	85.47	-50.04	0.37	-49.67	-36.00	-13.67	HORIZONTAL
2	193.83	-56.35	1.70	-54.65	-54.00	-0.65	HORIZONTAL
3	596.22	-77.35	11.10	-66.25	-54.00	-12.25	HORIZONTAL
4	667.22	-76.39	11.93	-64.46	-54.00	-10.46	HORIZONTAL
5	743.70	-77.56	14.04	-63.52	-36.00	-27.52	HORIZONTAL
6	818.18	-75.63	14.44	-61.19	-36.00	-25.19	HORIZONTAL
7	1994.95	-61.59	4.75	-56.84	-30.00	-26.84	HORIZONTAL
8	4960.00	-71.17	16.15	-55.02	-30.00	-25.02	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

6.9 ETSI EN 300 328 SUB-CLAUSE 4.3.2.10 Receiver Spurious Emissions

This requirement applies to all types of equipment using wide band modulations other than FHSS.

6.9.1 Limit: Sub-Clause 4.3.2.10.3

The spurious emissions of the receiver shall not exceed the values given in table 10.

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 10: Spurious emission limits for receivers

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

6.9.2 Test Procedure:

See Sub-Clause 5.4.10.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.10.2 and 5.4.10.2.2 of ETSI EN 300 328 for Conducted Pre-Scan test method.

See Sub-Clause 5.4.10.2.2 of ETSI EN 300 328 for final Radiated test method.

6.9.3 Test Result:

Model: BM840 (PIFA Ant.)

Test Mode: BLE mode, RX CH Low

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	36.07	-64.65	6.41	-58.24	-57.00	-1.24	VERTICAL
2	84.75	-60.08	1.00	-59.08	-57.00	-2.08	VERTICAL
3	336.71	-64.79	5.18	-59.61	-57.00	-2.61	VERTICAL
4	602.26	-74.44	10.19	-64.25	-57.00	-7.25	VERTICAL
5	743.26	-79.34	13.73	-65.61	-57.00	-8.61	VERTICAL
6	817.08	-77.07	13.92	-63.15	-57.00	-6.15	VERTICAL
7	1994.42	-64.96	4.60	-60.36	-47.00	-13.36	VERTICAL
8	5403.41	-72.51	17.59	-54.92	-47.00	-7.92	VERTICAL
1	33.22	-68.42	9.65	-58.77	-57.00	-1.77	HORIZONTAL
2	108.80	-60.19	1.29	-58.90	-57.00	-1.90	HORIZONTAL
3	216.68	-60.65	2.41	-58.24	-57.00	-1.24	HORIZONTAL
4	337.02	-62.98	4.81	-58.17	-57.00	-1.17	HORIZONTAL
5	594.47	-77.95	11.08	-66.87	-57.00	-9.87	HORIZONTAL
6	740.89	-77.62	13.94	-63.68	-57.00	-6.68	HORIZONTAL
7	1483.99	-65.70	2.28	-63.42	-47.00	-16.42	HORIZONTAL
8	5263.47	-72.73	16.82	-55.91	-47.00	-8.91	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: BLE mode, RX CH High

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	84.69	-59.93	1.00	-58.93	-57.00	-1.93	VERTICAL
2	216.58	-61.63	2.73	-58.90	-57.00	-1.90	VERTICAL
3	337.41	-63.93	5.18	-58.75	-57.00	-1.75	VERTICAL
4	740.72	-78.04	13.74	-64.30	-57.00	-7.30	VERTICAL
5	817.66	-75.85	13.92	-61.93	-57.00	-4.93	VERTICAL
6	947.83	-76.93	17.65	-59.28	-57.00	-2.28	VERTICAL
7	1973.63	-67.38	4.50	-62.88	-47.00	-15.88	VERTICAL
8	4941.29	-72.67	16.32	-56.35	-47.00	-9.35	VERTICAL
1	192.71	-60.04	1.70	-58.34	-57.00	-1.34	HORIZONTAL
2	247.30	-62.59	4.38	-58.21	-57.00	-1.21	HORIZONTAL
3	520.47	-73.40	9.08	-64.32	-57.00	-7.32	HORIZONTAL
4	666.00	-77.94	11.93	-66.01	-57.00	-9.01	HORIZONTAL
5	742.96	-77.56	14.04	-63.52	-57.00	-6.52	HORIZONTAL
6	817.10	-76.69	14.44	-62.25	-57.00	-5.25	HORIZONTAL
7	4605.21	-71.00	14.95	-56.05	-47.00	-9.05	HORIZONTAL
8	6530.59	-73.50	23.84	-49.66	-47.00	-2.66	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Model: BM840P (Dipole Ant.)

Test Mode: BLE mode, RX CH Low

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	36.61	-64.76	6.41	-58.35	-57.00	-1.35	VERTICAL
2	85.39	-59.89	1.00	-58.89	-57.00	-1.89	VERTICAL
3	338.08	-64.45	5.18	-59.27	-57.00	-2.27	VERTICAL
4	602.49	-74.30	10.19	-64.11	-57.00	-7.11	VERTICAL
5	743.89	-78.93	13.73	-65.20	-57.00	-8.20	VERTICAL
6	818.64	-77.16	13.92	-63.24	-57.00	-6.24	VERTICAL
7	1996.61	-64.19	4.60	-59.59	-47.00	-12.59	VERTICAL
8	5404.37	-71.78	17.59	-54.19	-47.00	-7.19	VERTICAL
1	34.90	-68.16	9.65	-58.51	-57.00	-1.51	HORIZONTAL
2	110.79	-59.29	1.29	-58.00	-57.00	-1.00	HORIZONTAL
3	218.14	-58.93	2.41	-56.52	-57.00	0.48	HORIZONTAL
4	337.22	-62.68	4.81	-57.87	-57.00	-0.87	HORIZONTAL
5	596.08	-76.42	11.08	-65.34	-57.00	-8.34	HORIZONTAL
6	741.35	-77.79	13.94	-63.85	-57.00	-6.85	HORIZONTAL
7	1484.52	-65.37	2.28	-63.09	-47.00	-16.09	HORIZONTAL
8	5264.30	-71.69	16.82	-54.87	-47.00	-7.87	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: BLE mode, RX CH High

Ambient temperature: 20℃ Relative humidity: 66% Test Date: 2022/01/20

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.54	-59.04	1.00	-58.04	-57.00	-1.04	VERTICAL
2	216.89	-60.79	2.73	-58.06	-57.00	-1.06	VERTICAL
3	338.23	-63.08	5.18	-57.90	-57.00	-0.90	VERTICAL
4	741.21	-76.29	13.74	-62.55	-57.00	-5.55	VERTICAL
5	818.54	-76.31	13.92	-62.39	-57.00	-5.39	VERTICAL
6	948.21	-76.01	17.65	-58.36	-57.00	-1.36	VERTICAL
7	1974.22	-65.03	4.50	-60.53	-47.00	-13.53	VERTICAL
8	4942.50	-71.14	16.32	-54.82	-47.00	-7.82	VERTICAL
1	192.91	-59.40	1.70	-57.70	-57.00	-0.70	HORIZONTAL
2	247.77	-62.08	4.38	-57.70	-57.00	-0.70	HORIZONTAL
3	521.80	-72.14	9.08	-63.06	-57.00	-6.06	HORIZONTAL
4	667.29	-76.57	11.93	-64.64	-57.00	-7.64	HORIZONTAL
5	745.32	-76.69	14.04	-62.65	-57.00	-5.65	HORIZONTAL
6	817.74	-75.68	14.44	-61.24	-57.00	-4.24	HORIZONTAL
7	4605.27	-70.93	14.95	-55.98	-47.00	-8.98	HORIZONTAL
8	6531.08	-72.67	23.84	-48.83	-47.00	-1.83	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

6.10 ETSI EN 300 328 SUB-CLAUSE 4.3.2.11 Receiver Blocking

This requirement applies to all receiver categories below.

Receiver categories

Receiver category 1
Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Receiver category 2
Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

Receiver category 3
Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

6.10.1 Limit: Sub-Clause 4.3.2.11.3

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided table 11, table 12 or table 13.

Table 11: Receiver Blocking parameters receiver category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2380 2504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2300 2330 2360 2524 2584		

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 20 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

Table 12: Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2380 2504 2300 2584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

Table 13: Receiver Blocking parameters receiver category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2380 2504 2300 2584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to Pmin + 30 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

6.10.2 Test Procedure:

See Sub-Clause 5.4.11.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.4.11.2 of ETSI EN 300 328 for conducted method.

6.10.3 Test Result:

The receiver blocking setup (conducted) shown in section Test & System Description was used to measure receiver blocking signal. The signaling Unit is a CMW500.The packet error rate (PER) is measured with the CMW500.
The blocking signal is emulated by the Signal generator SMB100B. Antenna gain and insertion loss are taken into account.
The declared antenna gain is 1.54 dBi

Configuration	99% Occupied bandwidth (MHz)	Wanted signal mean power from companion device (dBm)	PER (%) Without blocking signal	Blocking signal(MHz)	Blocking Frequency Offset (MHz)	Blocking signal Power (dBm)	PER (%) With Blocking signal	Verdict
		without blocking signal		with blocking signal				
BLE channel 37 2402MHz	1.08	-65	0.2	2380	0	-32.5	8	PASS
			0.3	2300	0	-32.5	7.7	PASS
		without blocking signal		with blocking signal				
BLE channel 39 2480MHz	1.08	-65	0.4	2504	0	-32.5	9.4	PASS
			0.3	2584	0	-32.5	7.2	PASS

Note: The wanted signal mean power from the companion device and the blocking signal power level values are compensated with the declared antenna gain on table above

6.11 ETSI EN 300 328 SUB-CLAUSE 4.3.2.12 Geo-location capability

This requirement only applies to equipment with geo-location capability as defined in ETSI EN 300 328 clause 4.3.1.12.2 below

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

6.11.1 Requirement: Sub-Clause 4.3.2.12.3

The geographical location determined by the equipment as defined in clause 4.3.2.12.2 shall not be accessible to the user.

6.11.2 Result:

PASS, the device has Geo-location capability, but this function will not be accessible to the user.

APPENDIX 1

PHOTOGRAPHS OF SET UP

PCB Antenna

Dipole Antenna

APPENDIX 2

PHOTOGRAPHS OF EUT

Please refer to the file ISL-22LR0022P