EN 300 328 RF Test Report (BT-LE)

Report No.:	REBBUI-WTW-P21040655-4
Test Model:	RTL8852BE
Received Date:	Apr. 21, 2021
Test Date:	May 12 to 28, 2021
Issued Date:	Aug. 05, 2021
Applicant:	Realtek Semiconductor Corp.
Address:	No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

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Release Control Record

Issue No.	Description	Date Issued
REBBUI-WTW-P21040655-4	Original release.	Aug. 05, 2021

1 Certificate of Conformity

Product:	11ax RTL8852BE Combo module
Brand:	REALTEK
Test Model:	RTL8852BE
Sample Status:	Engineering sample
Applicant:	Realtek Semiconductor Corp.
Test Date:	May 12 to 28, 2021
Standards:	EN 300 328 V2.2.2 (2019-07)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** Aug. 05, 2021

Vivian Huang / Specialist

Approved by : , **Date:** Aug. 05, 2021

Clark Lin / Technical Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V2.2.2		
Clause	**Test Parameter**	**Results**
4.3.2.2	RF Output Power	Pass
4.3.2.3	Power Spectral Density	Pass
4.3.2.4	Duty cycle, Tx-sequence, Tx-gap (Non-adaptive equipment)	Not Applicable
4.3.2.5	Medium Utilization (MU) Factor (Non-Adaptive Equipment)	Not Applicable
4.3.2.6	Adaptivity (non-FHSS)	Pass
4.3.2.7	Occupied Channel Bandwidth	Pass
4.3.2.8	Transmitter Unwanted Emissions in the out-of-band Domain	Pass
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass
4.3.2.10	Receiver Spurious Emissions	Pass
4.3.2.11	Receiver Blocking	Pass
4.3.2.12	Geo-location capability	Not Applicable

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Test Instruments

For spurious emissions test (Below 1GHz)

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY54490570	June 16, 2020	June 15, 2021
Pre_Amplifier Agilent	8447D	2944A10663	Apr. 26, 2021	Apr. 25, 2022
TRILOG Antenna SCHWARZBECK	VULB9168	9168-162	Nov. 09, 2020	Nov. 08, 2021
Software	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208411	NA	NA
Power meter Anritsu	ML2495A	1529002	July 22, 2020	July 21, 2021
Power sensor Anritsu	MA2411B	1339443	July 22, 2020	July 21, 2021
Power meter Anritsu	ML2496A	1529003	Aug. 05, 2020	Aug. 04, 2021
Power sensor Anritsu	MA2411B	1339442	Aug. 05, 2020	Aug. 04, 2021
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 18, 2020	Nov. 17, 2021

NOTE:
1. The test was performed in RF Fully Chamber No. 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: May 25 to 28, 2021

For spurious emissions test (Above 1GHz)

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY55410176	June 30, 2020	June 29, 2021
Pre_Amplifier HP	8449B	3008A01923	Oct. 08, 2020	Oct. 07, 2021
Pre_Amplifier EMCI	EMC184045	980143	Jan. 05, 2021	Jan. 04, 2022
Horn_Antenna SCHWARZBECK	BBHA 9120 D	9120D-1592	Nov. 22, 2020	Nov. 21, 2021
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
Software	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208542	NA	NA
Power meter Anritsu	ML2495A	1529002	July 22, 2020	July 21, 2021
Power sensor Anritsu	MA2411B	1339443	July 22, 2020	July 21, 2021
Power meter Anritsu	ML2496A	1529003	Aug. 05, 2020	Aug. 04, 2021
Power sensor Anritsu	MA2411B	1339442	Aug. 05, 2020	Aug. 04, 2021
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 18, 2020	Nov. 17, 2021

NOTE:
1. The test was performed in RF Fully Chamber No. 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: May 12, 2021

For receiver blocking & adaptivity test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSW8	101497	Nov. 10, 2020	Nov. 09, 2021
Spectrum Analyzer Keysight	N9030A	MY55410176	June 30, 2020	June 29, 2021
Bluetooth Simulator Anritsu	MT8852B	1218002	May 19, 2020	May 18, 2021
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 18, 2020	Nov. 17, 2021
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53052700	July 14, 2020	July 13, 2021
Direct Coupler EMCI	CS20-18-436/16	1139	Jan. 11, 2021	Jan. 10, 2022
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S+	408501327_03	Sep. 30, 2020	Sep. 29, 2021
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S+	408501327_04	Sep. 30, 2020	Sep. 29, 2021

NOTE:
1. The test was performed in Adaptivity room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: May 14 to 15, 2021

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	101516	Mar. 08, 2021	Mar. 07, 2022
Spectrum Analyzer Keysight	N9030A	MY54490570	June 16, 2020	June 15, 2021
AC Power Source Extech Electronics	6905S	1991551	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Nov. 24, 2020	Nov. 23, 2021
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 18, 2020	Nov. 17, 2021
Power meter Anritsu	ML2495A	0824006	Apr. 28, 2021	Apr. 27, 2022
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53052700	July 14, 2020	July 13, 2021
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_01	Sep. 16, 2020	Sep. 15, 2021
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_02	Nov. 13, 2020	Nov. 12, 2021
Switch Box Agilent	PS-X10-100	PS-X10-100_01	Sep. 17, 2020	Sep. 16, 2021

NOTE:
1. The test was performed in Oven room 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: May 24, 2021

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Parameter	Uncertainty
Occupied Channel Bandwidth	±0.14x10^{-4} %
RF output power, conducted	±1.2 dB
Power Spectral Density, conducted	±1.2 dB
Unwanted Emissions, conducted	±2.5 dB
All emissions, radiated	±4.9 dB
Temperature	±0.4 °C
Supply voltages	±0.05 %
Time	±5 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028-1, in particular in annex D of the ETSI TR 100 028-2.

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1,5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±1 °C
Supply voltages	±3 %
Time	±5 %

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	11ax RTL8852BE Combo module
Brand	REALTEK
Test Model	RTL8852BE
Status of EUT	Engineering sample
Nominal Voltage	3.3Vdc from host equipment
Normal Testing Voltage	Vnom= 3.3Vdc
Temperature Operating Range	-20℃ ~ 70℃
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 2 Mbps
Operating Frequency	2.402 ~ 2.480 GHz
Number of Channel	40
Adaptive/Non-Adaptive	☐ non-adaptive Equipment ☒ adaptive Equipment without the possibility to switch to a non-adaptive mode ☐ adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power	**BT-LE 1M:** 9.85 dBm **BT-LE 2M:** 11.07 dBm
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The EUT has below HW SKU configuration, as below table:

SKU No.	Interface	Description
1	PCIe + USB	Single antenna port
2	PCIe + USB	Dual antenna port
3	PCIe + UART	Dual antenna port

Note:
1. For spurious emissions (below 1GHz): From the above HW SKUs, the worse case was found in **SKU No.: 3**. Therefore only the test data of the SKU was recorded in this report.
2. For spurious emissions (above 1GHz): From the above HW SKUs, the worse case was found in **SKU No.: 2**. Therefore only the test data of the SKU was recorded in this report.

2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN 5GHz	Bluetooth
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

3. The antennas provided to the EUT, please refer to the following table:

Ant. Set	RF Chain No.	Brand	Model	Ant. Net Gain (dBi)	Frequency Range (GHz)	Ant. Type	Connector Type	Cable Length (mm)
1	Chain 0	ARISTOTLE	RFA-27-JP326-MHF4300	3.5	2.4~2.4835	PIFA	i-pex(MHF)	300
				5	5.15~5.85			
				5	5.875~7.125			
	Chain 1	ARISTOTLE	RFA-27-JP326-MHF4300	3.5	2.4~2.4835	PIFA	i-pex(MHF)	300
				5	5.15~5.85			
				5	5.875~7.125			
2	Chain 0	ARISTOTLE	RFA-27-C38H1-MHF4300	3	2.4~2.4835	Dipole	i-pex(MHF)	300
				5	5.15~5.85			
				5	5.875~7.125			
	Chain 1	ARISTOTLE	RFA-27-C38H1-MHF4300	3	2.4~2.4835	Dipole	i-pex(MHF)	300
				5	5.15~5.85			
				5	5.875~7.125			

Note:
1. Max. gain was selected for the final test, except for Spurious Emissions & Adaptivity test.

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
5. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

40 channels are provided for BT-LE mode:

RF Channel	RF Center Frequency	Channel Index	Channels Type for BT 5.x		Channels Type for BT 4.x
			Maximum Data Rate 2Mbps	Maximum Data Rate 1Mbps	Maximum Data Rate 1Mbps
0	2402 MHz	37		●	●
1	2404 MHz	0	●		●
2	2406 MHz	1	●		●
3	2408 MHz	2	●		●
4	2410 MHz	3	●		●
5	2412 MHz	4	●		●
6	2414 MHz	5	●		●
7	2416 MHz	6	●		●
8	2418 MHz	7	●		●
9	2420 MHz	8	●		●
10	2422 MHz	9	●		●
11	2424 MHz	10	●		●
12	2426 MHz	38		●	●
13	2428 MHz	11	●		●
14	2430 MHz	12	●		●
15	2432 MHz	13	●		●
16	2434 MHz	14	●		●
17	2436 MHz	15	●		●
18	2438 MHz	16	●		●
19	2440 MHz	17	●		●
20	2442 MHz	18	●		●
21	2444 MHz	19	●		●
22	2446 MHz	20	●		●
23	2448 MHz	21	●		●
24	2450 MHz	22	●		●
25	2452 MHz	23	●		●
26	2454 MHz	24	●		●
27	2456 MHz	25	●		●
28	2458 MHz	26	●		●
29	2460 MHz	27	●		●
30	2462 MHz	28	●		●
31	2464 MHz	29	●		●
32	2466 MHz	30	●		●
33	2468 MHz	31	●		●
34	2470 MHz	32	●		●
35	2472 MHz	33	●		●
36	2474 MHz	34	●		●
37	2476 MHz	35	●		●
38	2478 MHz	36	●		●
39	2480 MHz	39		●	●

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to										Description
	ROP	PSD	DC/TS/TG	MU	AD	OCB	EOB	SE< 1G	SE≥ 1G	RB	
1	√	√	-	-	√	√	√	√	√	√	High power
2	√	√	-	-	-	√	√	-	-	-	Low power

Where **ROP:** RF Output Power
PSD: Power Spectral Density
DC/TS/TG: Duty Cycle/ Tx-Sequence / Tx-gap
MU: Medium Utilization
AD: Adaptivity (Channel Access Mechanism)
OCB: Occupied Channel Bandwidth
EOB: Transmitter unwanted emissions in the out-of-band domain
SE<1G: Unwanted Emissions in the Spurious Domain below 1 GHz
SE≥1G: Unwanted Emissions in the Spurious Domain above 1 GHz
RB: Receiver Blocking

Note: The EUT's PIFA antenna had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

RF Output Power Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	DTS	GFSK	1
1 to 38	1, 19, 38	DTS	GFSK	2

Power Spectral Density Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	DTS	GFSK	1
1 to 38	1, 19, 38	DTS	GFSK	2

Adaptivity Test:

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology
0 to 39	0, 39	GFSK

Occupied Channel Bandwidth Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	DTS	GFSK	1
1 to 38	1, 19, 38	DTS	GFSK	2

Transmitter Unwanted Emissions in the Out-of-band Domain Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	DTS	GFSK	1
1 to 38	1, 19, 38	DTS	GFSK	2

Unwanted Emissions in the Spurious Domain Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	39	DTS	GFSK	1
0 to 39 (Receiver)	39	-	-	-

Unwanted Emissions in the Spurious Domain Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 39	DTS	GFSK	1
0 to 39 (Receiver)	0, 39	-	-	-

Receiver Blocking test:

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 39	DTS	GFSK	1

Test Condition:

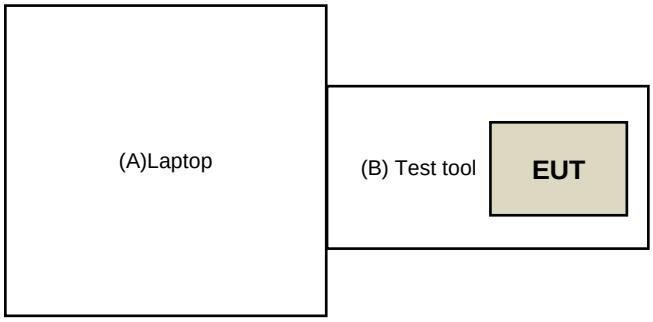
Applicable to	Environmental Conditions	Input Power	Tested by
ROP	25deg. C, 60%RH	3.3Vdc	Dolly Chung
PSD	25deg. C, 60%RH	3.3Vdc	Dolly Chung
AD	25deg. C, 60%RH	3.3Vdc	Gary Cheng
OCB	25deg. C, 60%RH	3.3Vdc	Dolly Chung
EOB	25deg. C, 60%RH	3.3Vdc	Dolly Chung
SE<1G	22deg. C, 72%RH,	230Vac, 50Hz (System)	Ethan Hsu
SE≥1G	25deg. C, 67%RH,	230Vac, 50Hz (System)	Ethan Hsu
RB	23deg. C, 60%RH	3.3Vdc	Tobey Chen

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab
B.	Test tool	Realtek	N/A	NA	NA	Supplied by client

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V2.2.2 (2019-07)

All test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

4.1 RF Output Power

4.1.1 Limits of RF Output Power

Condition	Frequency Band	Limit (e.i.r.p.)
Under all test conditions	2400 ~ 2483.5 MHz	AV: 20dBm

4.1.2 Test Procedures

Refer to chapter 5.4.2 of EN 300 328 V2.2.2.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

For extreme test condition refer to chapter Annex B.4 and procedure follow Annex B.4.3.

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup

The measurements for RF output power was performed at both normal environmental conditions and at the extremes of the operating temperature. Controlling software (Bluetooth RF test tool (5.2.3.1)) has been activated to set the EUT on specific channel and power level.

4.1.5 Test Results (Mode 1)

BT-LE 1M

Test Condition			EIRP Power (dBm)		
			(CH0) 2402 MHz	(CH19) 2440 MHz	(CH39) 2480 MHz
T_{nom}(℃)	25	V_{nom}(v)	9.66	9.71	9.68
T_{min}(℃)	-20	V_{nom}(v)	9.85	9.82	9.75
T_{max}(℃)	70	V_{nom}(v)	9.42	9.37	9.44

BT-LE 2M

Test Condition			EIRP Power (dBm)		
			(CH1) 2404 MHz	(CH19) 2440 MHz	(CH38) 2478 MHz
Tnom(℃)	25	Vnom(v)	10.80	10.82	10.77
Tmin(℃)	-20	Vnom(v)	11.07	11.03	10.91
Tmax(℃)	70	Vnom(v)	10.60	10.61	10.53

4.1.6 Test Results (Mode 2)

BT-LE 1M

Test Condition			EIRP Power (dBm)		
			(CH0) 2402 MHz	(CH19) 2440 MHz	(CH39) 2480 MHz
T_{nom}(℃)	25	V_{nom}(v)	9.10	9.11	9.08
T_{min}(℃)	-20	V_{nom}(v)	9.29	9.22	9.15
T_{max}(℃)	70	V_{nom}(v)	8.86	8.77	8.84

BT-LE 2M

Test Condition			EIRP Power (dBm)		
			(CH1) 2404 MHz	(CH19) 2440 MHz	(CH38) 2478 MHz
Tnom(℃)	25	Vnom(v)	9.68	9.73	9.70
Tmin(℃)	-20	Vnom(v)	9.95	9.94	9.84
Tmax(℃)	70	Vnom(v)	9.48	9.52	9.46

4.2 Power Spectral Density

4.2.1 Limit of Power Spectral Density

Condition	Frequency Band	Limit (e.i.r.p.)
Under normal conditions	2400 ~ 2483.5 MHz	10dBm / 1MHz

4.2.2 Test Procedures

Refer to chapter 5.4.3 of EN 300 328 V2.2.2.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous and non-continuous transmissions	
☐ Option 2: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Basedequipment)	

4.2.3 Deviation of Test Standard

No deviation.

4.2.4 Test Setup

The test setup has been constructed as the normal test condition. (In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator.) The power spectral density as defined in EN 300 328 clause 4.3.2.3 shall be measured and recorded. Controlling software (Bluetooth RF test tool (5.2.3.1)) has been activated to set the EUT on specific status.

4.2.5 Test Results (Mode 1)

BT-LE 1M

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
0	2402	9.60	10	Pass
19	2440	9.66	10	Pass
39	2480	9.62	10	Pass

BT-LE 2M

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2404	9.75	10	Pass
19	2440	9.77	10	Pass
38	2478	9.76	10	Pass

4.2.6 Test Results (Mode 2)

BT-LE 1M

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
0	2402	9.04	10	Pass
19	2440	9.04	10	Pass
39	2480	9.02	10	Pass

BT-LE 2M

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2404	8.63	10	Pass
19	2440	8.72	10	Pass
38	2478	8.67	10	Pass

4.3 Adaptivity (non-FHSS)

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

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

4.3.1 Limit of Adaptive

Applicability of adaptive requirements and limit for wide band modulation techniques

Requirement	Operational Mode			
	Using Detect and Avoid	LBT mechanism		
		Frame Based Equipment	Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)	Load Based Equipment (Not using any of the mechanisms referenced)
Minimum Clear Channel Assessment (CCA) Time	NA	18 us	(see note 1)	18 us
Maximum Channel Occupancy (COT) Time	40 ms	1 ms - 10 ms	(see note 1)	13ms
Minimum Idle Period	5% of COT	5% of COT	(see note 1)	18us (see note 2)
Extended CCA check	NA	NA	(see note 1)	18us – 160us
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see note 3)			

NOTE 1: Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™ [i.3], clause 10 clause 11, clause 15,clause 16, clause 18 and clause 19, or in IEEE 802.15.4™ [i.4], clause 5, clause 6 and clause 10

NOTE 2: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.

NOTE 3: Adaptive equipment may or may not have Short Control Signalling Transmissions

Threshold Level for Non-LBT based Detect and Avoid	
Maximum transmit power (P_H) EIRP dBm	**Threshold level (TL) (see notes 1 and 2)**
20	-70 dBm / MHz

NOTE 1: For a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)

NOTE 2: For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to: $TL = -70 \text{ dBm/MHz} + 10 \times \log_{10}(100 \text{ mW} / P_{out})$; (P_{out} in mW e.i.r.p.)

Unwanted signal parameters for Non-LBT based Detect and Avoid		
Wanted signal mean power from companion device (dBm)	**Unwanted signal frequency (MHz)**	**Unwanted CW signal power (dBm)**
-30	2 395 or 2 488,5 (see note 1)	-35 (see note 2)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz.

NOTE 2: 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.

Threshold Level for LBT based Detect and Avoid (Frame Based Equipment)	
Maximum transmit power (P_H) EIRP dBm	**Threshold level (TL) (see notes 1 and 2)**
20	-70 dBm / MHz
NOTE 1: For a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)	
NOTE 2: For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to: $TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$; (P_{out} in mW e.i.r.p.)	

Unwanted signal parameters for LBT based Detect and Avoid (Frame Based Equipment)		
Wanted signal mean power from companion device	**Unwanted signal frequency (MHz)**	**Unwanted signal power (dBm)**
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 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 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.		

Threshold Level for LBT based Detect and Avoid (Load Based Equipment)	
Maximum transmit power (P_H) EIRP dBm	**Threshold level (TL) (see notes 1 and 2)**
20	-70 dBm / MHz
NOTE 1: For a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)	
NOTE 2: For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to: $TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$; (P_{out} in mW e.i.r.p.)	

Unwanted signal parameters for LBT based Detect and Avoid (Load Based Equipment)		
Wanted signal mean power from companion device	**Unwanted signal frequency (MHz)**	**Unwanted signal power (dBm)**
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 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 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.		

4.4 Test Procedure

Refer to chapter 5.4.6 of EN 300 328 V2.2.2.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.4.1 Deviation from Test Standard

No deviation.

4.4.2 Test Setup Configuration

Companion Device information

Product	Brand	Model No.
Bluetooth Test Set	Anritsu	MT8852B

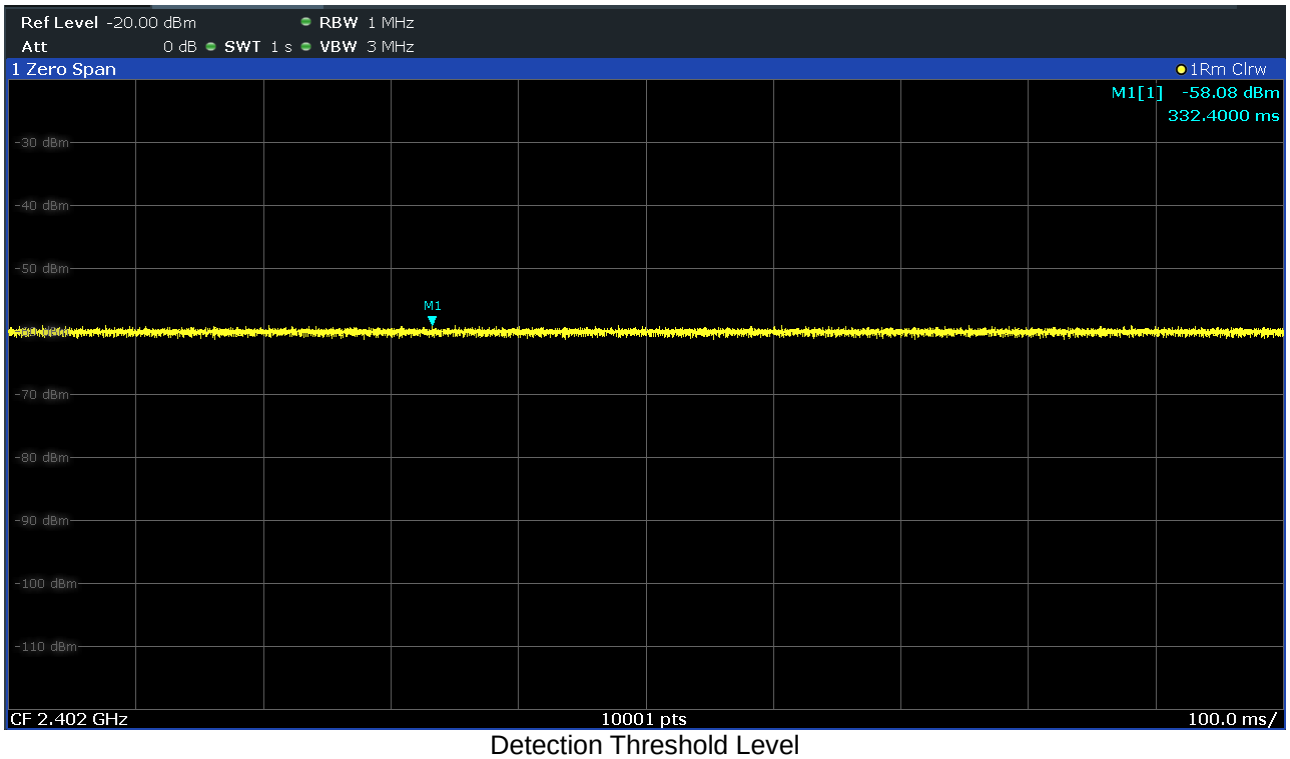
4.4.3 List of Measurements

UUT Operational Mode	Applicable	Limit	
		The Maximum Channel Occupancy Time	The Minimum idle Period
Frame Based Equipment		meet in 1ms ~ 10ms	>5% x channel occupancy time
Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)		Follow IEEE 802.11 Less than _____ms	Follow IEEE 802.11 More than _____ms
Load Based Equipment (Not using any of the mechanisms referenced)	v	13ms	18us

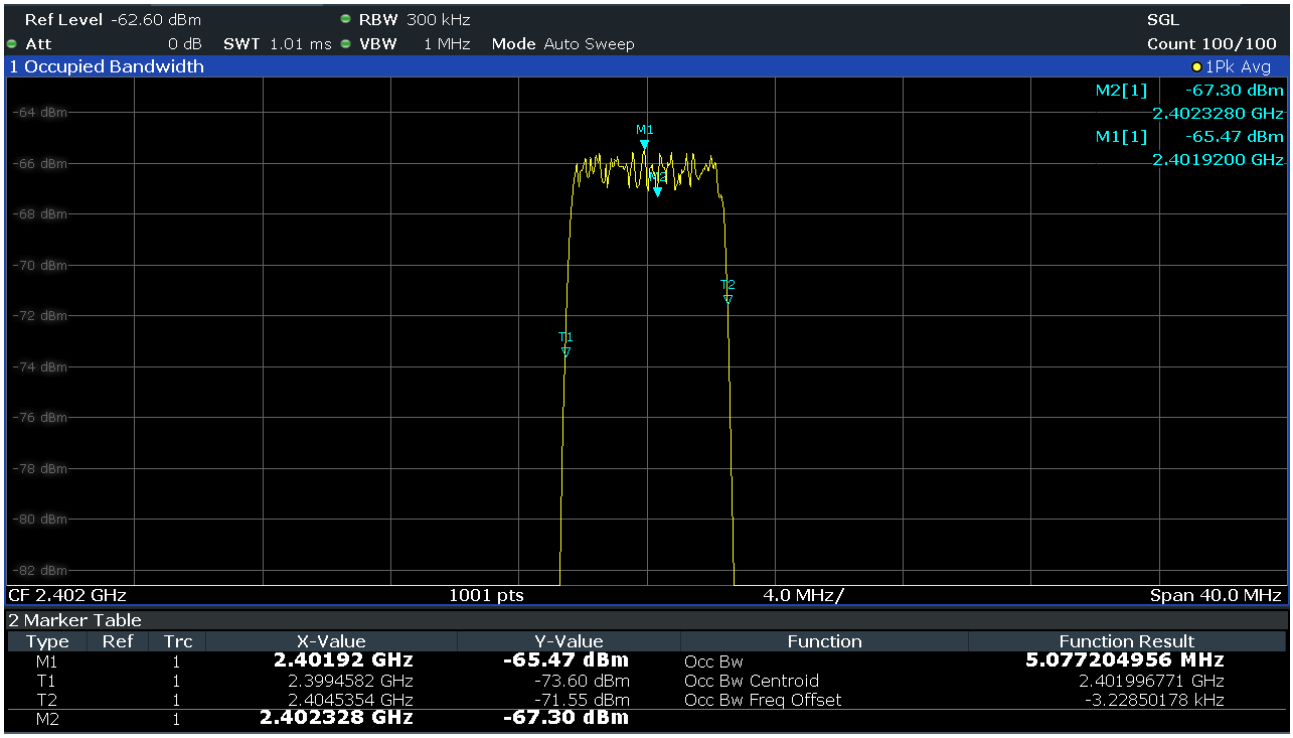
Clause	Test Parameter	Remarks	Pass/Fail
4.3.2.6.3.2.2	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.3.2.6.3.2.3	Adaptive (Load Based Equipment)	Applicable	Pass
4.3.2.6.4	Short Control Signalling Transmissions	Applicable	Pass
4.3.2.6.3.2.3.6	Unwanted signal test	Applicable	Pass

4.4.4 Interference Threshold Level

Detection Threshold Level
The maximum EIRP (nom) power is 10.82 dBm (12.08 mW) and antenna gain is 3 dBi. Detection Threshold level= -70 dBm/MHz + 10×log(100 mW / Pout (12.08 mW)) + G (3 dBi) = -57.82 dBm/MHz The interference signal level to the UUT is lower than -57.82 dBm/MHz.



Detection Threshold Level



Flatness and Bandwidth

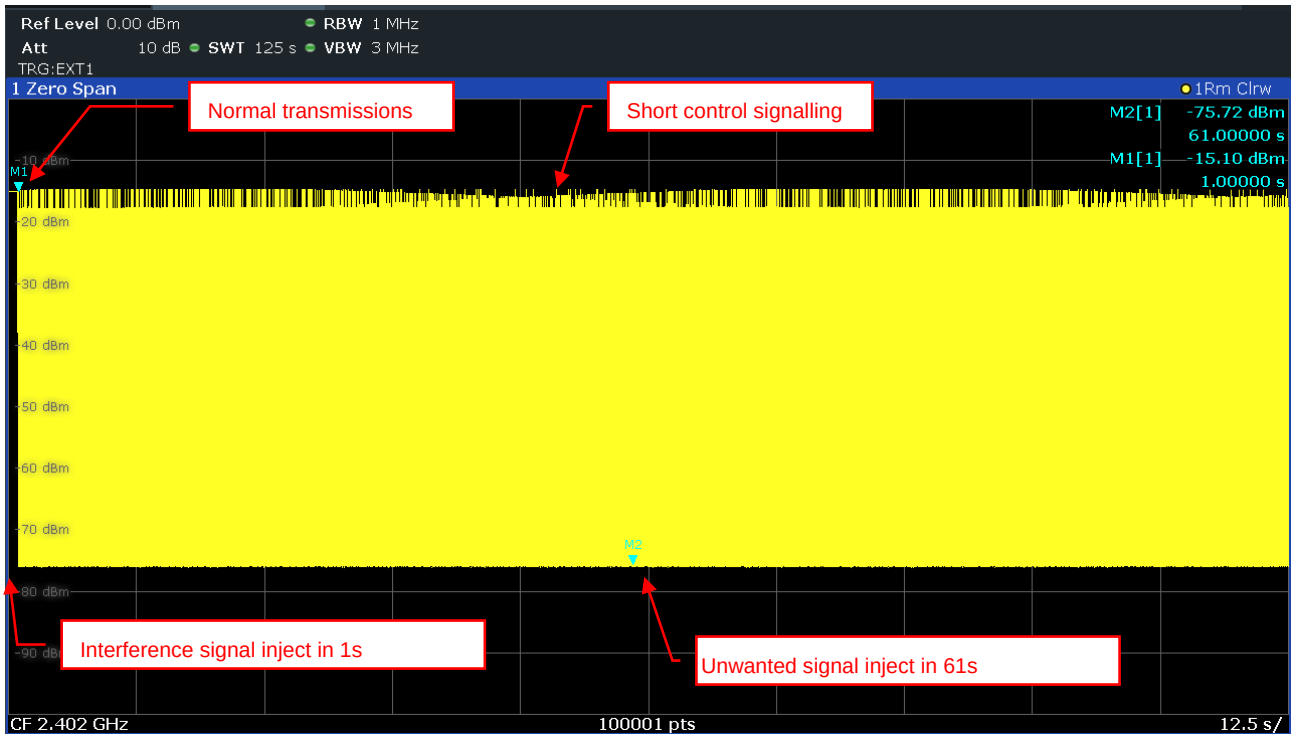
4.4.5 Test Result

☐	Not applicable to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode
☐	Not applicable to equipment with RF output power is less than 10 dBm e.i.r.p.
☒	Refer to below test result

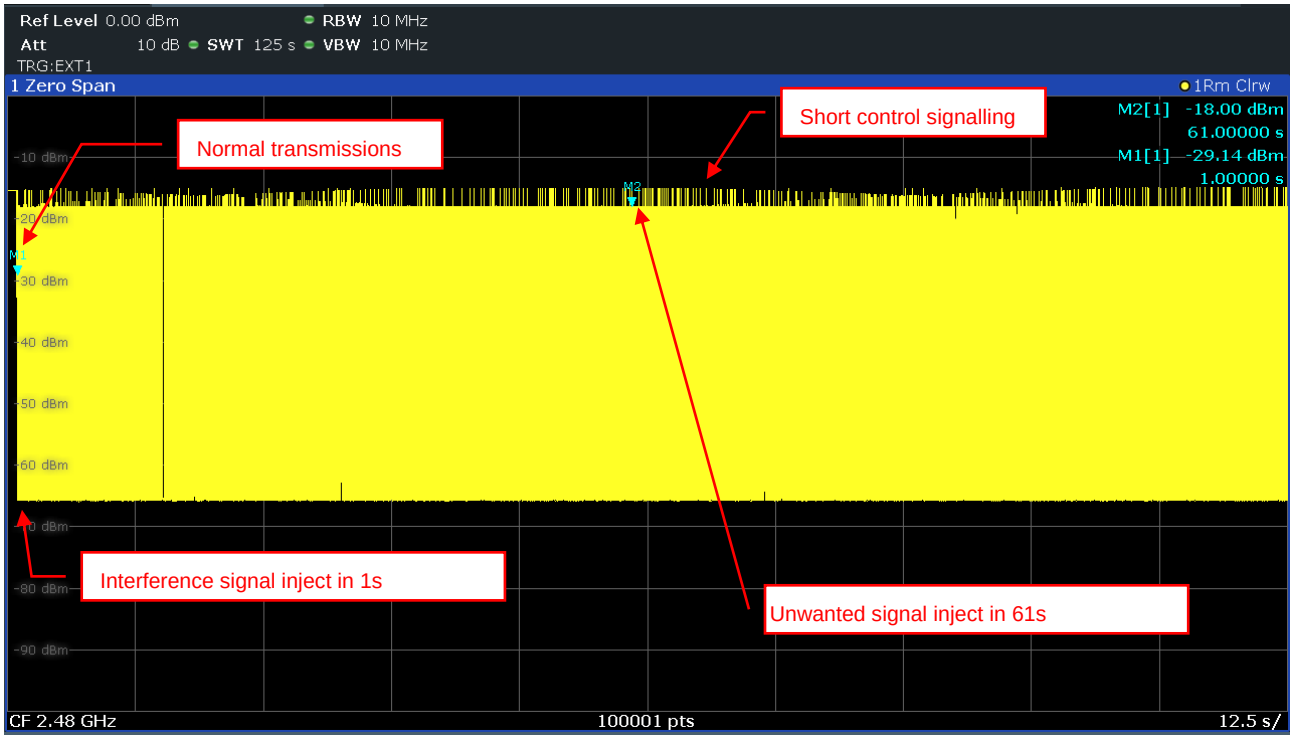
4.4.5.1 Adaptive Result

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency	Test Result
BT-LE	2402	Pass



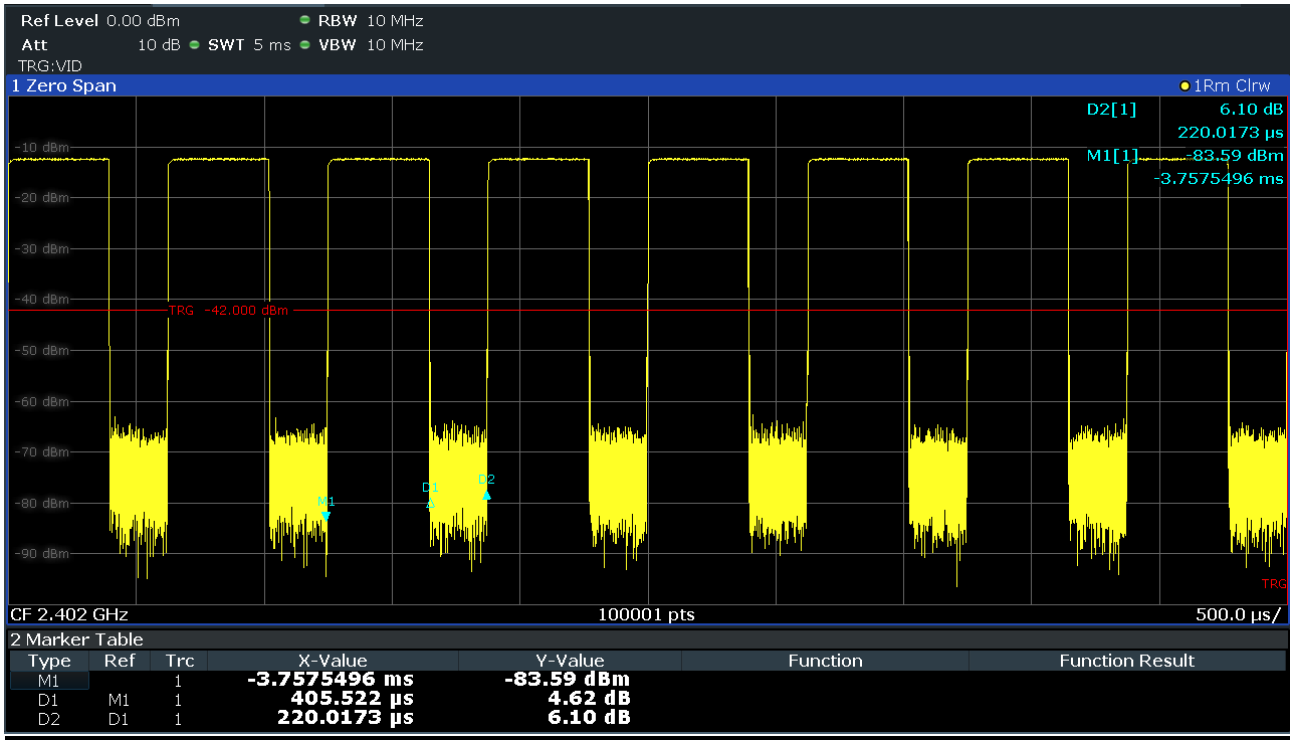
Operational Mode	Operating Frequency	Test Result
BT-LE	2480	Pass

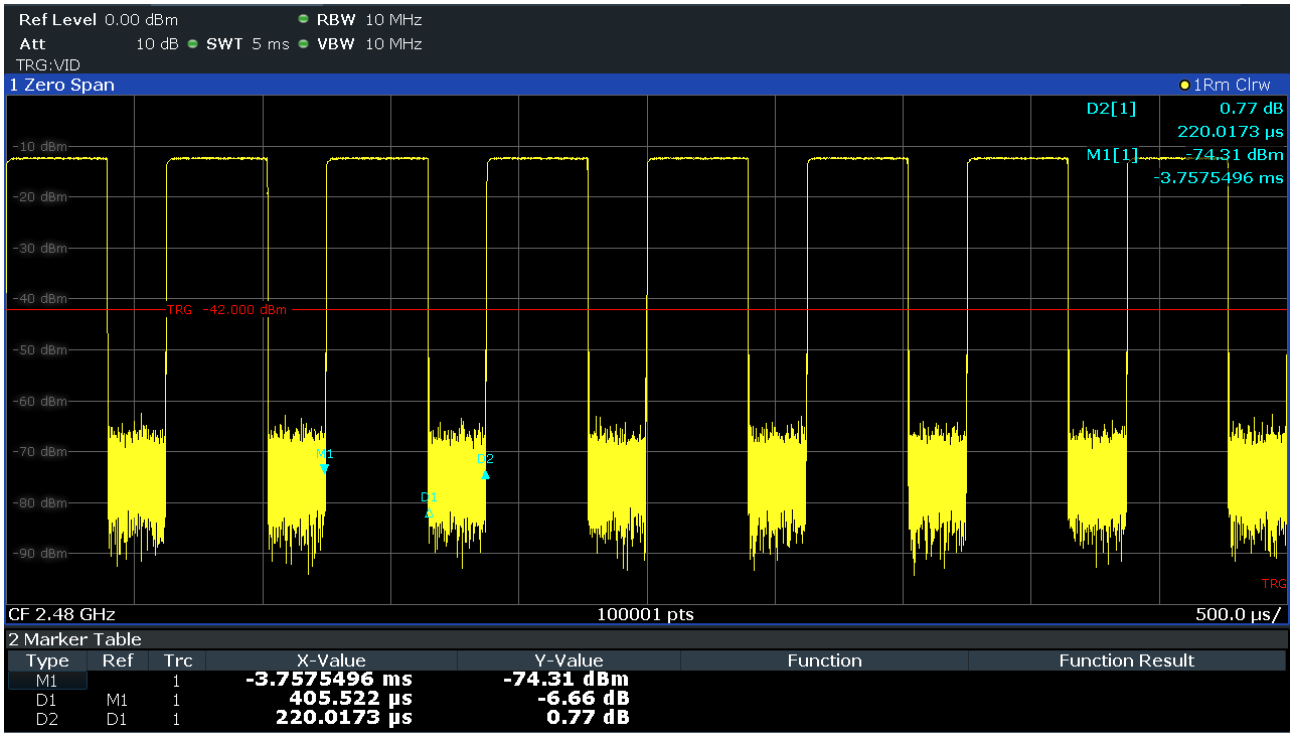


4.4.5.2 The Channel Occupancy Time Result

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
BT-LE	2402	0.41	220.02	Pass
BT-LE	2480	0.41	220.02	Pass

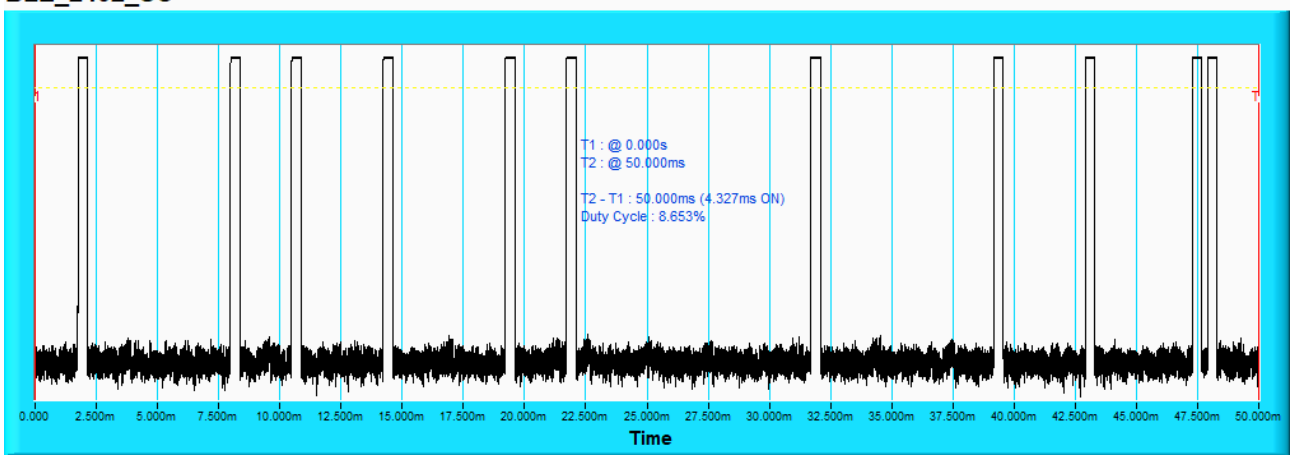




4.4.5.3 Short Control Signalling Transmissions Result

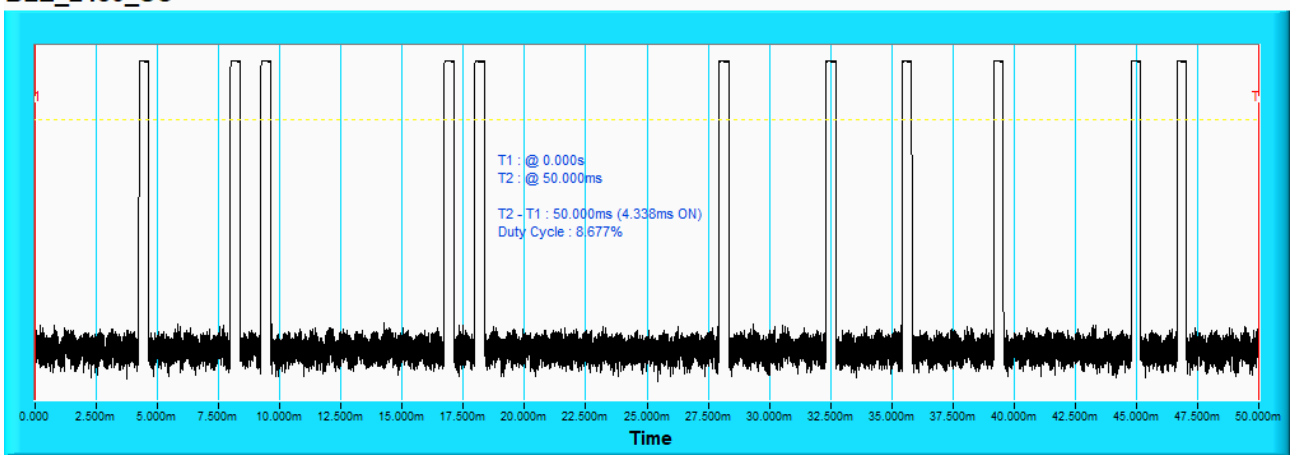
Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	Pass/Fail
4.33 ms	5 ms	Pass

BLE_2402_SC



Short Control Signalling Transmission Result		
SCST total on time	SCST Limit	Pass/Fail
4.34 ms	5 ms	Pass

BLE_2480_SC



4.4.5.4 Unwanted Signal interference Test Results

Operational Mode	Operating Frequency (MHz)	Wanted signal mean power from companion device (dBm/MHz)	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)	Test Result
BLE	2402	-50	2488.5	-31.5	Pass
	2480	-50	2395	-31.5	Pass

4.5 Occupied Channel Bandwidth

4.5.1 Limit of Occupied Channel Bandwidth

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz.
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p >10dBm.	Less than 20MHz
	For non-adaptive Frequency Hopping system and e.i.r.p >10dBm.	Less than 5MHz

4.5.2 Test Procedure

Refer to chapter 5.4.7 of EN 300 328 V2.2.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

4.5.3 Deviation from Test Standard

No deviation.

4.5.4 Test Setup

These measurements only were performed at normal test conditions. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software (Bluetooth RF test tool (5.2.3.1)) has been activated to set the EUT on specific status.

4.5.5 Test Results (Mode 1)

BT-LE 1M

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F_L (MHz)	F_H (MHz)		
0	2402	1.04	2401.49	2402.53	F_L > 2400 MHz and F_H < 2483.5 MHz	Pass
39	2480	1.04	2479.49	2480.53		Pass

BT-LE 2M

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F_L (MHz)	F_H (MHz)		
1	2404	2.04	2403.01	2405.05	F_L > 2400 MHz and F_H < 2483.5 MHz	Pass
38	2478	2.06	2476.99	2479.05		Pass

4.5.6 Test Results (Mode 2)

BT-LE 1M

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F_L (MHz)	F_H (MHz)		
0	2402	1.03	2401.5	2402.53	F_L > 2400 MHz and F_H < 2483.5 MHz	Pass
39	2480	1.04	2479.49	2480.53		Pass

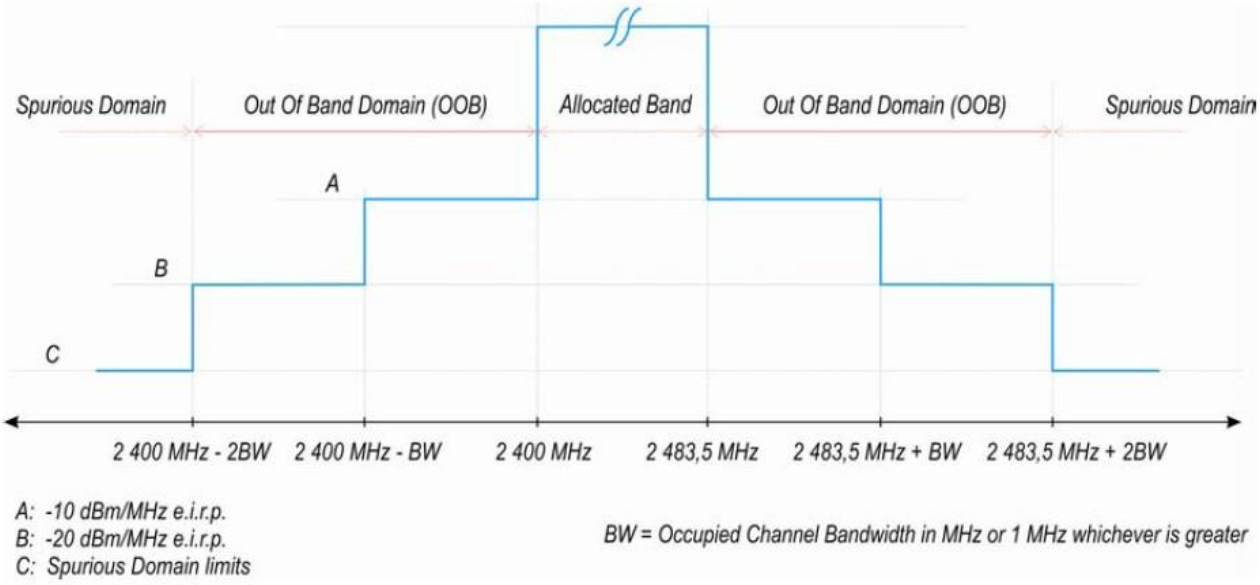
BT-LE 2M

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F_L (MHz)	F_H (MHz)		
1	2404	2.04	2403.01	2405.05	F_L > 2400 MHz and F_H < 2483.5 MHz	Pass
38	2478	2.06	2477.01	2479.07		Pass

4.6 Transmitter Unwanted Emissions in the Out-of-band Domain

4.6.1 Limits of Transmitter Unwanted Emissions in the Out-of-band Domain

Condition	Limit
Under normal conditions	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 below figure.



4.6.2 Test Procedure

Refer to chapter 5.4.8 of EN 300 328 V2.2.2.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.6.3 Deviation from Test Standard

No deviation

4.6.4 Test Setup

The measurements were performed at normal environmental conditions. The measurement was performed at the lowest and the highest channel on which the equipment can operate. The equipment was configured to operate under its worst case situation with respect to output power. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.

4.6.5 Test Results (Mode 1)

BT-LE 1M

Channel Frequency		2402 MHz				2480 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2398.96 ~ 2400		2397.92 ~ 2398.96		2483.5 ~ 2484.54		2484.54 ~ 2485.58	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T_{nom} 25℃	V_{nom}(v)	2399.50	-38.77	2398.46	-46.96	2484.00	-48.01	2485.04	-49.14
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

BT-LE 2M

Channel Frequency		2404 MHz				2478 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2397.96 ~ 2400		2395.92 ~ 2397.96		2483.5 ~ 2485.56		2485.56 ~ 2487.62	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T_{nom} 25℃	V_{nom}(v)	2399.50	-45.98	2397.46	-48.90	2484.00	-49.05	2486.06	-49.80
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

4.6.6 Test Results (Mode 2)

BT-LE 1M

Channel Frequency		2402 MHz				2480 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2398.97 ~ 2400		2397.94 ~ 2398.97		2483.5 ~ 2484.54		2484.54 ~ 2485.58	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T_{nom} 25℃	V_{nom}(v)	2399.50	-38.61	2398.47	-46.91	2484.00	-48.16	2485.04	-49.18
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

BT-LE 2M

Channel Frequency		2404 MHz				2478 MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2397.96 ~ 2400		2395.92 ~ 2397.96		2483.5 ~ 2485.56		2485.56 ~ 2487.62	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T_{nom} 25℃	V_{nom}(v)	2399.50	-46.62	2397.46	-49.24	2484.00	-49.28	2486.06	-49.97
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

4.7 Transmitter Spurious Emissions in the Spurious Domain

4.7.1 Limits of Transmitter Spurious Emissions

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87,5 MHz	-36dBm	100kHz
87,5 MHz to 118 MHz	-54dBm	100kHz
118 MHz to 174 MHz	-36dBm	100kHz
174 MHz to 230 MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 694 MHz	-54dBm	100kHz
694 MHz to 1 GHz	-36dBm	100kHz
1GHz ~ 12.75GHz	-30dBm	1MHz

Note: These limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

4.7.2 Test Procedure

Refer to chapter 5.4.9 of EN 300 328 V2.2.2.

Measurement Method	
☐ Conducted measurement	☒ Radiated measurement

For Conducted measurement:
The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).

Conducted measurement (For equipment with multiple transmit chains):

☐ Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.

☐ Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by 10 x log (N) (number of active transmit chains)

4.7.3 Deviation from Test Standard

No deviation.

4.7.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The equipment was configured to operate under its worst case situation with respect to output power.
3. The test setup has been constructed as the normal use condition. Controlling software (Bluetooth RF test tool (5.2.3.1)) has been activated to set the EUT on specific status.

4.7.5 Test Results

Dipole Antenna

Below 1GHz Worst-case Data

BT-LE 1M

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
117.85	V	-66.63	-54.00	-12.63
144.01	H	-53.99	-36.00	-17.99
205.59	H	-67.63	-54.00	-13.63
220.42	V	-71.36	-54.00	-17.36
479.98	V	-68.95	-54.00	-14.95
480.03	H	-64.12	-54.00	-10.12
497.94	H	-62.87	-54.00	-8.87
506.44	V	-69.15	-54.00	-15.15
516.84	H	-65.21	-54.00	-11.21
535.59	V	-67.98	-54.00	-13.98
544.00	H	-66.00	-54.00	-12.00
551.31	V	-65.62	-54.00	-11.62
575.44	H	-66.36	-54.00	-12.36
589.42	H	-65.99	-54.00	-11.99
600.01	V	-63.54	-54.00	-9.54
612.99	H	-70.64	-54.00	-16.64
624.98	V	-72.75	-54.00	-18.75
652.49	V	-75.30	-54.00	-21.30
663.83	H	-63.74	-54.00	-9.74
663.88	V	-64.32	-54.00	-10.32

Above 1GHz Worst-case Data

BT-LE 1M

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	7206.00	H	-58.13	-30.00	-28.13
	7206.00	V	-56.66	-30.00	-26.66
	9608.00	H	-56.02	-30.00	-26.02
	9608.00	V	-55.71	-30.00	-25.71
39	7440.00	H	-57.19	-30.00	-27.19
	7440.00	V	-55.97	-30.00	-25.97
	9920.00	H	-55.27	-30.00	-25.27
	9920.00	V	-55.78	-30.00	-25.78

PIFA Antenna

Below 1GHz Worst-case Data

BT-LE 1M

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
117.85	V	-66.65	-54.00	-12.65
210.97	H	-68.75	-54.00	-14.75
222.91	V	-74.07	-54.00	-20.07
479.98	H	-64.55	-54.00	-10.55
480.68	V	-70.67	-54.00	-16.67
498.04	H	-65.08	-54.00	-11.08
502.86	V	-69.41	-54.00	-15.41
523.26	H	-66.09	-54.00	-12.09
540.77	V	-69.05	-54.00	-15.05
564.20	V	-68.80	-54.00	-14.80
567.78	H	-64.97	-54.00	-10.97
579.82	H	-68.85	-54.00	-14.85
600.01	V	-63.99	-54.00	-9.99
608.27	H	-69.79	-54.00	-15.79
624.98	V	-72.76	-54.00	-18.76
625.03	H	-69.76	-54.00	-15.76
643.84	H	-73.71	-54.00	-19.71
644.33	V	-73.40	-54.00	-19.40
663.83	V	-64.79	-54.00	-10.79
666.47	H	-65.10	-54.00	-11.10

Above 1GHz Worst-case Data

BT-LE 1M

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

Spurious Emission Level					
Channel	**Frequency (MHz)**	**Antenna Polarization**	**Level (dBm)**	**Limit (dBm)**	**Margin (dB)**
0	7206.00	H	-57.88	-30.00	-27.88
	7206.00	V	-58.46	-30.00	-28.46
	9608.00	H	-54.30	-30.00	-24.30
	9608.00	V	-55.12	-30.00	-25.12
39	7440.00	H	-56.17	-30.00	-26.17
	7440.00	V	-57.78	-30.00	-27.78
	9920.00	H	-53.10	-30.00	-23.10
	9920.00	V	-55.37	-30.00	-25.37

4.8 Receiver Spurious Emissions

4.8.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz ~ 1 GHz	-57dBm	100 kHz
1 GHz ~ 12.75 GHz	-47dBm	1 MHz

Note: These limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

4.8.2 Test Procedure

Refer to chapter 5.4.10 of EN 300 328 V2.2.2.

Measurement Method	
☐ Conducted measurement	☒ Radiated measurement
For Conducted measurement: The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).	
Conducted measurement (For equipment with multiple transmit chains): ☐ Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits. ☐ Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by 10 x log (N) (number of active transmit chains)	

4.8.3 Deviation from Test Standard

No deviation.

4.8.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The test setup has been constructed as the normal use condition. Controlling software (Bluetooth RF test tool (5.2.3.1)) has been activated to set the EUT on specific status.

4.8.5 Test Results

Dipole Antenna

RX Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
35.07	V	-63.48	-57.00	-6.48
53.08	H	-61.55	-57.00	-4.55
84.97	V	-65.28	-57.00	-8.28
88.55	H	-60.08	-57.00	-3.08
99.74	V	-60.97	-57.00	-3.97
129.49	H	-60.29	-57.00	-3.29
144.02	V	-65.54	-57.00	-8.54
159.54	H	-64.51	-57.00	-7.51
166.55	V	-66.44	-57.00	-9.44
299.85	H	-62.23	-57.00	-5.23
299.87	V	-63.37	-57.00	-6.37
536.76	H	-62.69	-57.00	-5.69
666.45	H	-61.88	-57.00	-4.88
666.45	V	-62.32	-57.00	-5.32
697.00	H	-64.27	-57.00	-7.27
699.73	V	-63.09	-57.00	-6.09
765.40	H	-63.61	-57.00	-6.61
827.38	V	-67.18	-57.00	-10.18
839.27	V	-67.41	-57.00	-10.41
874.34	H	-62.07	-57.00	-5.07

RX Above 1GHz Data

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.00	H	-62.55	-47.00	-15.55
	4804.00	V	-64.12	-47.00	-17.12
39	4960.00	H	-62.99	-47.00	-15.99
	4960.00	V	-63.62	-47.00	-16.62

PIFA Antenna

RX Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36.07	V	-62.29	-57.00	-5.29
53.08	H	-61.40	-57.00	-4.40
87.85	H	-60.14	-57.00	-3.14
101.53	V	-63.07	-57.00	-6.07
128.99	H	-60.42	-57.00	-3.42
144.02	V	-65.13	-57.00	-8.13
159.94	H	-64.99	-57.00	-7.99
166.01	V	-67.46	-57.00	-10.46
299.47	V	-60.40	-57.00	-3.40
299.92	H	-60.99	-57.00	-3.99
544.92	H	-62.98	-57.00	-5.98
666.45	H	-62.63	-57.00	-5.63
666.45	V	-61.89	-57.00	-4.89
698.24	V	-65.56	-57.00	-8.56
699.73	H	-61.04	-57.00	-4.04
734.60	H	-64.06	-57.00	-7.06
811.61	V	-66.11	-57.00	-9.11
848.22	V	-67.84	-57.00	-10.84
960.00	H	-64.74	-57.00	-7.74
960.00	V	-67.52	-57.00	-10.52

RX Above 1GHz Data

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4803.00	H	-62.67	-47.00	-15.67
	4803.00	V	-63.76	-47.00	-16.76
39	4959.00	H	-61.76	-47.00	-14.76
	4959.00	V	-60.85	-47.00	-13.85

4.9 Receiver Blocking

4.9.1 Limit of Receiver Blocking

This requirement applies to all receiver categories.

Receiver Category		
☒Category 1	☐Category 2	☐Category 3
Minimum performance criterion	☒PER ≦10%	
	☐Alternative performance criteria (See note)	
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.		

Receiver Category 1 Equipment			
Wanted signal mean power from companion device (dBm) (see notes 1 to 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)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

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.

Receiver Category 2 Equipment			
Wanted signal mean power from companion device (dBm) (see notes 1 to 3)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see note 3)**	**Type of blocking signal**
(-139 dBm + 10 × $\log^{10}$(OCBW) +10) or (-74 dBm + 10) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-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.			

Receiver Category 3 Equipment			
Wanted signal mean power from companion device (dBm) (see notes 1 to 3)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (See note 3)**	**Type of blocking signal**
(-139 dBm + 10 × $\log^{10}$(OCBW) +20) or (-74 dBm + 20) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-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.			

4.9.2 Test Procedure

Refer to chapter 5.4.11 of EN 300 328 V2.2.2.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.9.3 Deviation from Test Standard

No deviation.

4.9.4 Test Setup Configuration

4.9.5 Test Results

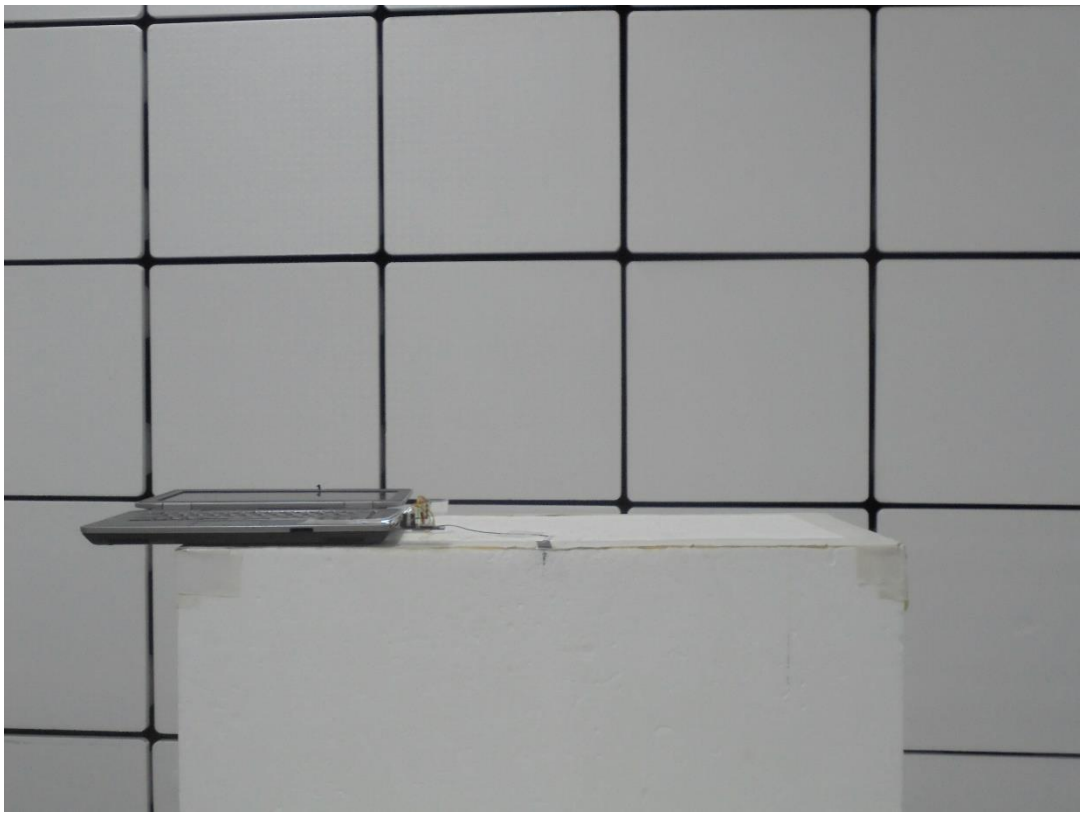
Receiver Category 1 Equipment

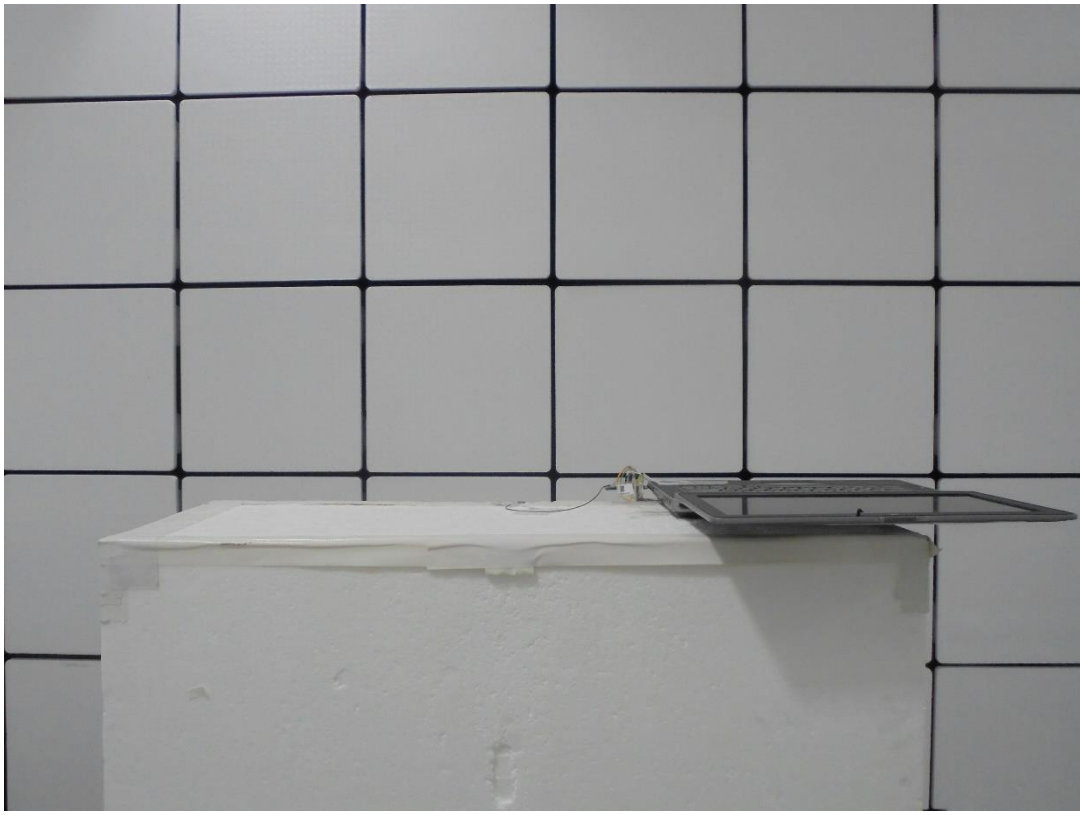
Receiver Blocking Measure Of The Capability					Blocking Signal Power		
CH 0:	OCBW (MHz):	1.04	Antenna Gain (dBi):	3.5	■ at the antenna connector		
CH 39:	OCBW (MHz):	1.04			□ in front of the antenna		
Operation Mode	**Channel Number**	**Wanted Signal Mean Power From Companion Device (dBm) (Note 1)**	**Blocking Signal Frequency (MHz)**	**Blocking Signal Frequency Shift (MHz) (Note 2)**	**Blocking Signal Power (dBm) (Note 1)**	**PER (%)**	**Test Result**
BT LE-1M	0	-69.33	2380	-	-30.5	3.3	Pass
		-75.33	2300	-	-30.5	2.9	Pass
			2330	-	-30.5	2.4	Pass
			2360	-	-30.5	2.2	Pass
	39	-69.33	2504	-	-30.5	3.5	Pass
		-75.33	2524	-	-30.5	1.8	Pass
			2584	-	-30.5	1.6	Pass
			2674	-	-30.5	2.7	Pass

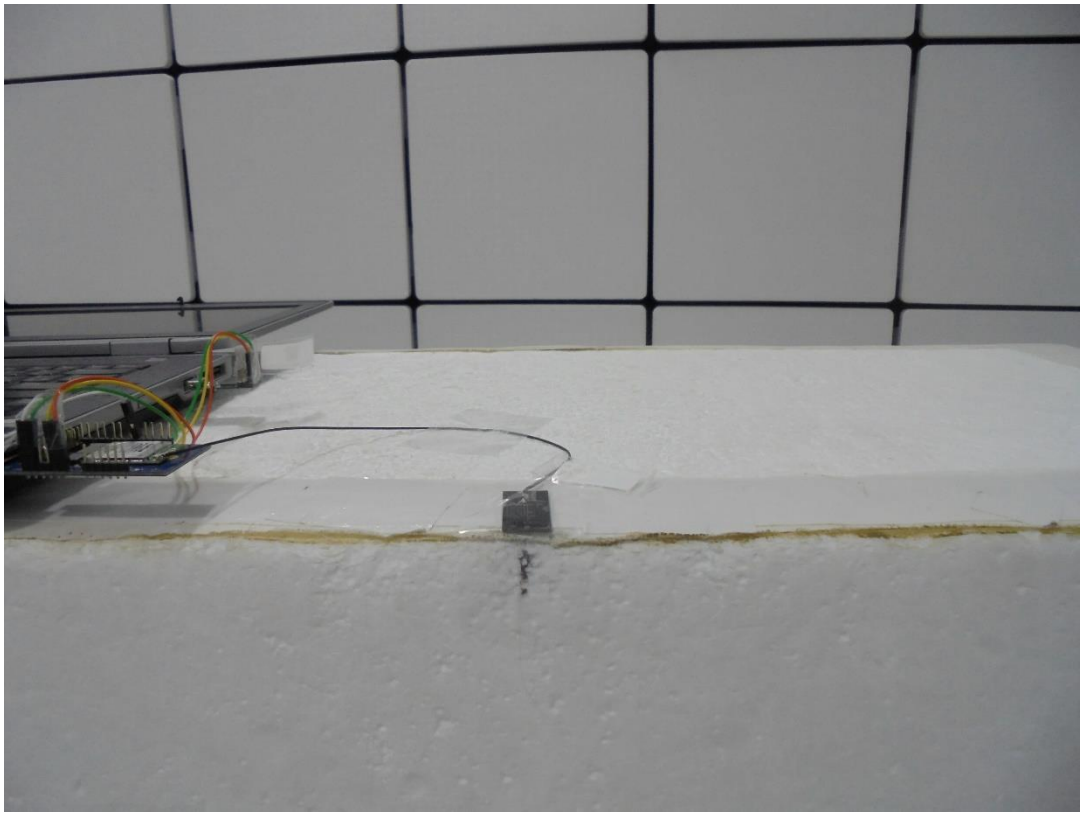
Note 1: In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G).
Note 2: If the performance criteria is not met, those frequencies of the blocking signal has been increased/decreased with a value equal to the Occupied Channel Bandwidth except the blocking frequencies 2380, 2504MHz shall be increased/decreased with a value equal to 10MHz also if the frequency offset is more than 7MHz, the level of the wanted signal shall be increased by 3dB.

5 Photographs of the Test Configuration

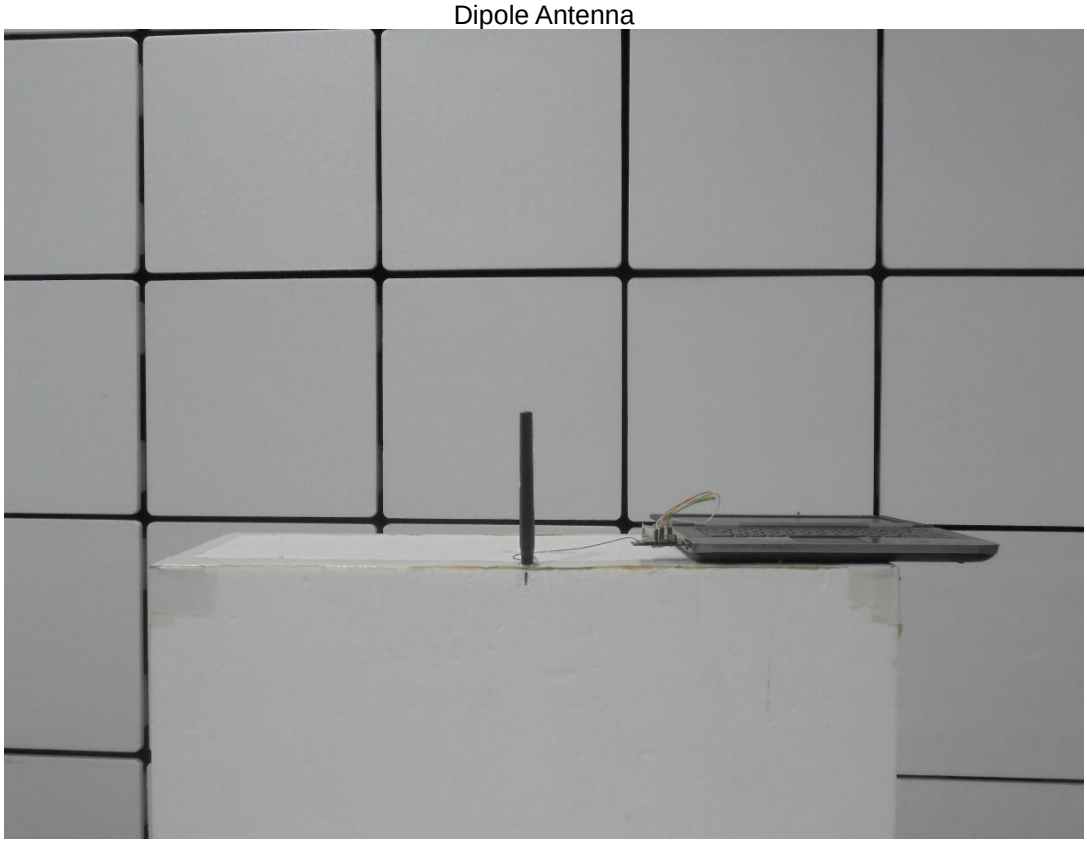
TX / RX Spurious Emission Test
PIFA Antenna







Dipole Antenna



Appendix A- Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
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Hsin Chu EMC/RF/Telecom Lab
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The address and road map of all our labs can be found in our web site also.

--- END ---

Appendix B- Test Results for reference by client's requirement

Receiver Category 1 Equipment

Receiver Blocking Measure Of The Capability					Blocking Signal Power		
CH 0:	OCBW (MHz):	1.04	Antenna Gain (dBi):	3.5	■ at the antenna connector		
CH 39:	OCBW (MHz):	1.04			□ in front of the antenna		
Operation Mode	**Channel Number**	**Wanted Signal Mean Power From Companion Device (dBm) (Note 1)**	**Blocking Signal Frequency (MHz)**	**Blocking Signal Frequency Shift (MHz) (Note 2)**	**Blocking Signal Power (dBm) (Note 1)**	**PER (%)**	**Test Result**
BT LE-1M	0	-97	2380	-	-30.5	4.8	Pass
		-97	2300	-	-30.5	5.2	Pass
			2330	-	-30.5	5.9	Pass
			2360	-	-30.5	5.3	Pass
	39	-96	2504	-	-30.5	6.1	Pass
		-92	2524	-	-30.5	7.2	Pass
			2584	-	-30.5	5.7	Pass
			2674	-	-30.5	4.9	Pass

Note 1: In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G).
Note 2: If the performance criteria is not met, those frequencies of the blocking signal has been increased/decreased with a value equal to the Occupied Channel Bandwidth except the blocking frequencies 2380, 2504MHz shall be increased/decreased with a value equal to 10MHz also if the frequency offset is more than 7MHz, the level of the wanted signal shall be increased by 3dB.