

BFi53MLG

Product Specification

v2.0

nRF5340 wireless MCU module · M.2 LGA 12 × 16 mm

FLSEMITM



BANFi
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BFi53MLG features

Features:

- Nordic Semiconductor nRF5340 wireless SoC (nRF5340-CLAA)
- Application core Arm Cortex-M33, 128 / 64 MHz
 - 1 MB flash, 512 KB RAM
 - Arm TrustZone, CryptoCell-312
- Network core Arm Cortex-M33, 64 MHz
 - 256 KB flash, 64 KB RAM
- 2 MB QSPI flash on module (W25Q16JV) for DFU / data logging
- RF front end SKY66405-11 (PA / LNA), i.PEX (U.FL) antenna connector
- *Bluetooth* LE 5: 1M / 2M / Coded PHY, Mesh, Long Range
- IEEE 802.15.4: Thread, Zigbee; ANT; proprietary 2.4 GHz
- Conducted TX < +6.5 dBm, EIRP < 9.8 dBm (certified antennas)
- Supplies: VDD_HV 2.7–5.5 V, FEM_VDD 2.7–3.6 V, USB VBUS 5 V
- System OFF 0.9 μ A, System ON 1.3 μ A
- Up to 45 configurable I/O

- USB 2.0 full speed, UART, SPI, I²C / TWI, I²S, PDM, PWM, 12-bit ADC, NFC-A
- M.2 LGA Type 1216 outline, 12 × 16 × 2.0 mm, 108 pads
- Operating temperature –40 to +105 °C
- Made in Taiwan

Certifications:

- FCC ID 2BDGV-M2X (modular)
- IC 31619-M2X
- Japan R 201-230707
- Taiwan NCC CCAJ22Y10181T9 (label authorisation)
- Bluetooth Declaration ID D066840
- CE (RED), AU/NZ RCM and VCCI test reports

Applications:

- Bluetooth Mesh lighting and building control
- Industrial sensing and gateways
- Thread / Zigbee smart home and building
- Wide-temperature outdoor and cabinet equipment

Revision history

Date	Version	Description
2026-10-05	2.0	Full edition: pin table checked against the 2024 schematic; Wi-Fi/BT 1216 comparison; FEM control; measured pad geometry and PCB stack-up; appearance renders; all certificates and test-report data; OEM labelling
2026-07	1.1	BANFi one-page summary
2023-07	1.0	DV-WM01-MLG Product Specification V1.0 (first release)

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1 Product overview

BFi53MLG is a wireless MCU module built on the Nordic Semiconductor nRF5340. It integrates an SKY66405-11 RF front end, 2 MB QSPI flash, a 32 MHz crystal and an i.PEX antenna connector, and supports *Bluetooth* LE (including Mesh and Long Range), Thread, Zigbee and proprietary 2.4 GHz protocols over -40 to $+105$ °C. The package is a $12 \times 16 \times 2.0$ mm, 108-pad M.2 LGA (Type 1216 outline).

The module holds FCC, ISCED, Japan radio and Bluetooth listings, with CE (RED), AU/NZ RCM and VCCI test reports and an NCC type-approval label authorisation. The certificate holder is DIVAN TRADING CO., LTD.; see chapters 6–7.

1.1 Part numbers

BFi53MLG is the BANFi part number. The certificates use the ABR-WM01-M series (main model ABR-WM01-MKE is the version on an M.2 Key E carrier board; ABR-WM01-M is the bare LGA module). The Bluetooth listing uses DIVAN's model numbers DV-MLG / DV-MKE. All four are the same radio design.

BANFi part number	BFi53MLG (this document)
Certified models	ABR-WM01-M (series model; bare LGA module) · main model ABR-WM01-MKE (with M.2 Key E carrier) · CE/RCM also cover ABR-WM01-MXX (XX = 0–9)
Bluetooth listing models	DV-MLG (this module) · DV-MKE (carrier version)
Certificate holder	DIVAN TRADING CO., LTD.; Taiwan NCC by label authorisation
SoC	Nordic Semiconductor nRF5340-CLAA (WLCSP)
Country of origin	Taiwan

Table 1: Part numbers

1.2 Block diagram

The block diagram shows the main components inside the module and its external interfaces.

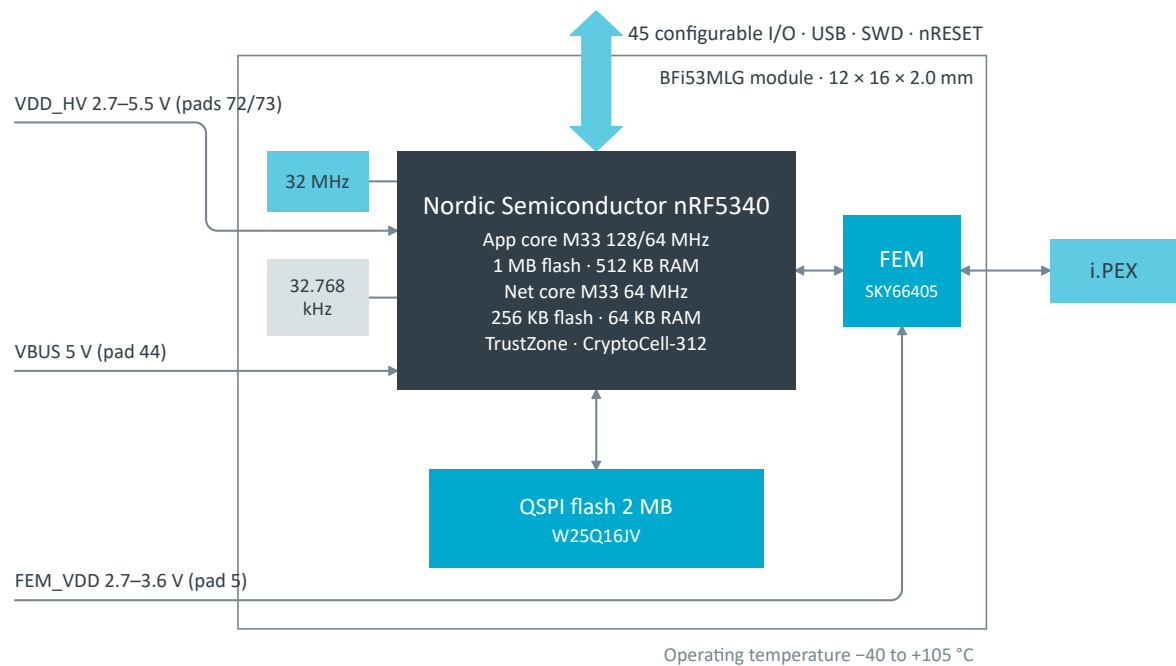


Figure 1: BFi53MLG block diagram

1.3 RF front-end control

The SKY66405-11 control lines are connected inside the module and are not brought out to pads:

FEM pin	nRF5340 GPIO	Function
CPS	P1.00	CPS = 1 bypass (about -2 dB); hold at 0 in normal operation
CTX	P1.04	CTX/CRX = 1/0 with CPS = 0: transmit
CRX	P1.05	CTX/CRX = 0/1 with CPS = 0: receive

Table 2: RF front-end control lines

Note: Firmware drives CTX / CRX through the MPSL FEM interface and holds CPS low. TX saturated gain is about 10 dB, RX gain about 13.5 dB.

2 Key specifications

The key specifications are summarised in the following table.

Radio	
Radio	Bluetooth LE 5 (1M / 2M / Coded PHY), Bluetooth Mesh, Long Range; IEEE 802.15.4 (Thread, Zigbee); ANT; proprietary 2.4 GHz
Frequency	2402 – 2480 MHz
TX power (application limit)	Conducted TX < +6.5 dBm; EIRP < 9.8 dBm (with the certified antennas)
Certified power	FCC 0.004 W (conducted); NCC 1M 6.28 / 2M 6.27 dBm (ABR-WM01-MKE), 1M 5.17 / 2M 5.15 dBm (ABR-WM01-M)
Antenna	i.PEX (U.FL) connector, external antenna; certified antennas in chapter 8
Processor and memory	
CPU	Dual Arm Cortex-M33: application core 128 / 64 MHz, network core 64 MHz
Application core memory	1 MB flash + 512 KB SRAM; 2 MB QSPI flash on module
Network core memory	256 KB flash + 64 KB RAM
Security	Arm TrustZone, CryptoCell-312
Operating system	Zephyr RTOS (nRF Connect SDK)
Interfaces	
Peripherals	USB 2.0 full speed, UART, SPI (incl. high-speed SPI), I ² C / TWI (1 Mbps), I ² S, PDM, PWM, 12-bit ADC (8 channels), NFC-A tag
GPIO	Up to 45 configurable I/O
Programming / debug	SWD (SWCLK / SWDIO), nRESET
Mechanical and environmental	
Package	12 × 16 × 2.0 mm M.2 LGA (Type 1216 outline), 108 pads
Operating temperature	–40 to +105 °C
Country of origin	Taiwan

Table 3: Key specifications

3 Electrical specification

3.1 Power supply

The module has three supply inputs.

Symbol	Pads	Range	Description
VDD_HV	72, 73	2.7 – 5.5 V	Main supply through the nRF5340 high-voltage regulator; 72 and 73 are the same net inside the module
FEM_VDD	5	2.7 – 3.6 V	RF front-end supply
VBUS	44	5 V (USB)	USB regulator input; may be left open when USB is not used
GND	see 4.1	—	All ground pads and the centre pads G1–G8 must be soldered and grounded

Table 4: Supply inputs

3.2 Current consumption

Condition	Typ.
System OFF	0.9 μ A
System ON (idle)	1.3 μ A
System ON + network-core RTC	1.5 μ A
System ON + 64 KB network-core RAM retained + RTC	1.7 μ A
FEM sleep / QSPI flash power-down	< 1 μ A each
Maximum (CoreMark + SoC TX/RX + FEM TX/RX)	54.7 mA

Table 5: Current consumption

Note: DC/DC or LDO mode can be chosen per application; all three DC/DC inductors (DCC $\leftrightarrow$ DECR, DCCD $\leftrightarrow$ DECD, DCCH $\leftrightarrow$ VDD) are fitted. Figures are from the DV-WM01-MLG PS 1.0 and the nRF5340 specification, not item-by-item measurements of this module. All certification tests ran at 3.3 Vdc (Japan also at 2.7 / 3.6 V); the safety reports rate the module at 3.3 Vdc.

4 Pin assignments

4.1 Pad layout

Pad numbering: left side 1–28 (top to bottom), bottom 29–48 (left to right), right side 49–76 (bottom to top), top 77–96 (right to left); corner pads G9–G12 = pads 97–100, centre pads G1–G8 = pads 101–108.



Figure 2: Pad layout

Pad	Name	Type	Description	Wi-Fi/BT 1216 reference
1	P1.11	I/O	General-purpose I/O	NC
2	P1.12	I/O	General-purpose I/O	NC
3	P0.02 / NFC1	I/O	General-purpose I/O; NFC antenna input	GPIO
4	P1.13	I/O	General-purpose I/O	NC
5	FEM_VDD	Power	RF front-end (FEM) supply 2.7–3.6 V	3V3_VBAT
6	GND	GND	Ground	GND
7	P1.02 / TWI	I/O	General-purpose I/O; high-speed TWI (1 Mbps) SDA	GPIO / TWI
8	P1.03 / TWI	I/O	General-purpose I/O; high-speed TWI (1 Mbps) SCL	GPIO / TWI
9	P0.03 / NFC2	I/O	General-purpose I/O; NFC antenna input	GPIO
10	P1.14	I/O	General-purpose I/O	NC
11	nRESET	Input	Reset (internal pull-up)	COEX1_SYNC

Pad	Name	Type	Description	Wi-Fi/BT 1216 reference
12	SWCLK	Debug	SWD clock (programming / debug)	COEX2_PRI
13	SWDIO	Debug	SWD data (programming / debug)	COEX3_ACTIVE
14	P0.08	I/O	General-purpose I/O	NC
15	P0.09 / MOSI	I/O	General-purpose I/O; high-speed SPI	NC
16	P0.10 / MISO	I/O	General-purpose I/O; high-speed SPI	Reserved
17	GND	GND	Ground	GND
18	P0.11 / CSN	I/O	General-purpose I/O; high-speed SPI	NC
19	P0.12 / DCX	I/O	General-purpose I/O; high-speed SPI	NC
20	GND	GND	Ground	GND
21	P0.04 / AIN0	I/O	General-purpose I/O; analog input	NC
22	P0.05 / AIN1	I/O	General-purpose I/O; analog input	NC
23	GND	GND	Ground	GND
24	P1.06	I/O	General-purpose I/O	BT_DEV_WAKE
25	P0.00 / XL1	I/O	General-purpose I/O; external 32.768 kHz crystal	NC
26	GND	GND	Ground	GND
27	P0.01 / XL2	I/O	General-purpose I/O; external 32.768 kHz crystal	SUSCLK
28	P0.06 / AIN2	I/O	General-purpose I/O; analog input	W_DISABLE
29	P0.07 / AIN3	I/O	General-purpose I/O; analog input	PCIE_WAKE
30	P0.25 / AIN4	I/O	General-purpose I/O; analog input	PCIE_CLKREQ
31	P0.26 / AIN5	I/O	General-purpose I/O; analog input	PCIE_PERST
32	GND	GND	Ground	GND
33	P0.27 / AIN6	I/O	General-purpose I/O; analog input	PCIE_RCLK_N
34	P0.28 / AIN7	I/O	General-purpose I/O; analog input	PCIE_RCLK_P
35	GND	GND	Ground	GND
36	NC	—	Not connected (leave floating)	PCIE_TX_N
37	NC	—	Not connected (leave floating)	PCIE_TX_P
38	GND	GND	Ground	GND
39	NC	—	Not connected (leave floating)	PCIE_RX_N
40	NC	—	Not connected (leave floating)	PCIE_RX_P
41	GND	GND	Ground	GND
42	NC	—	Not connected (leave floating)	NC
43	P1.07	I/O	General-purpose I/O	BT_I2S_WS
44	VBUS	Power	USB 5 V input (USB regulator)	NC
45	NC	—	Not connected (leave floating)	WL_EN
46	P1.01	I/O	General-purpose I/O	WAKE_GPIO_0
47	P0.13 / QSPI_I00	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC
48	P0.14 / QSPI_I01	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC
49	P0.15 / QSPI_I02	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC
50	P0.16 / QSPI_I03	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC

Pad	Name	Type	Description	Wi-Fi/BT 1216 reference
51	P0.17 / QSPI_CLK	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC
52	P0.18 / QSPI_CS	I/O	General-purpose I/O; QSPI (shared with on-module flash)	NC
53	P1.15	I/O	General-purpose I/O	BT_HOST_WAKE
54	P0.21	I/O	General-purpose I/O	UART_CTS
55	P0.20	I/O	General-purpose I/O	UART_TXD
56	P0.22	I/O	General-purpose I/O	UART_RXD
57	P0.19	I/O	General-purpose I/O	UART_RTS
58	P0.29	I/O	General-purpose I/O	PCM_SYNC
59	P0.30	I/O	General-purpose I/O	PCM_IN
60	P0.31	I/O	General-purpose I/O	PCM_OUT
61	P0.24	I/O	General-purpose I/O	PCM_CLK
62	GND	GND	Ground	GND
63	P0.23	I/O	General-purpose I/O	BT_ENABLE
64	P1.08	I/O	General-purpose I/O	BT_I2S_D0
65	NC	—	Not connected (leave floating)	WLAN_LED
66	P1.10	I/O	General-purpose I/O	BT_I2S_DI
67	P1.09	I/O	General-purpose I/O	BT_I2S_CLK
68	GND	GND	Ground	GND
69	D-	USB	USB D-	USB_D-
70	D+	USB	USB D+	USB_D+
71	GND	GND	Ground	GND
72	VDD_HV	Power	Main supply 2.7–5.5 V (same net as 73)	3V3
73	VDD_HV	Power	Main supply 2.7–5.5 V (same net as 72)	USB_VBUS 5 V
74	GND	GND	Ground	GND
75	GND	GND	Ground	GND
76	GND	GND	Ground	GND

Table 6: Pin assignments (pads 1–76)

Pads 77–96 (top row, 20 pads), 97–100 (corner G9–G12) and 101–108 (centre G1–G8) are all GND.

4.2 Relation to the M.2 LGA Type 1216 Wi-Fi/BT definition

The BFi53MLG pad map follows the pin definition of M.2 LGA Type 1216 Wi-Fi / Bluetooth modules, with nRF5340 signals placed at the matching positions. The right-hand column of the pin table in 4.1 is that Wi-Fi/BT reference.

Item	Versus the Wi-Fi/BT 1216 definition
Ground pads (6, 17, 20, 23, 26, 32, 35, 38, 41, 62, 68, 71, 74–108)	Same
USB D- / D+ (69 / 70)	Same

Item	Versus the Wi-Fi/BT 1216 definition
UART (54–57), PCM (58–61), BT I ² S (43, 64, 66, 67) positions	Positions kept; mapped to nRF5340 GPIO, function set by firmware
PCIe and unused pads (1, 2, 4, 10, 14–16, 18, 19, 21, 22, 28–34 ...)	Used for nRF5340 GPIO
Power: 5 (3V3_VBAT → FEM_VDD), 44 (NC → VBUS), 72 (3V3 → VDD_HV), 73 (USB_VBUS 5 V → VDD_HV)	Different; 72 and 73 are shorted inside the module

Table 7: Comparison with the Wi-Fi/BT 1216 definition

Note: BFi53MLG cannot be dropped onto a host board designed for a Wi-Fi/BT 1216 module. Such boards put 3.3 V on pad 72 and 5 V on pad 73, which the module shorts together, and drive PCIe signals into nRF5340 GPIO. The outline and land pattern match; power and signals must be designed to the pin assignments in this chapter.

5 Mechanical specifications and PCB design

5.1 Appearance

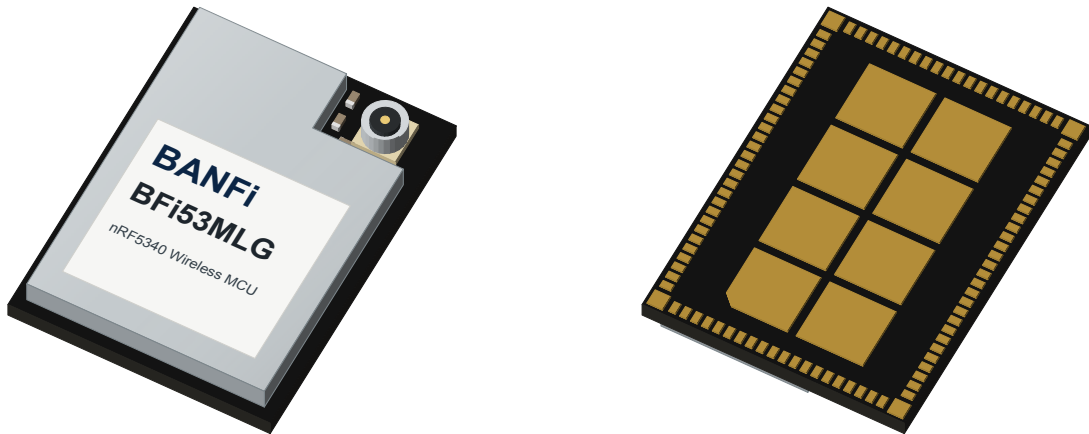
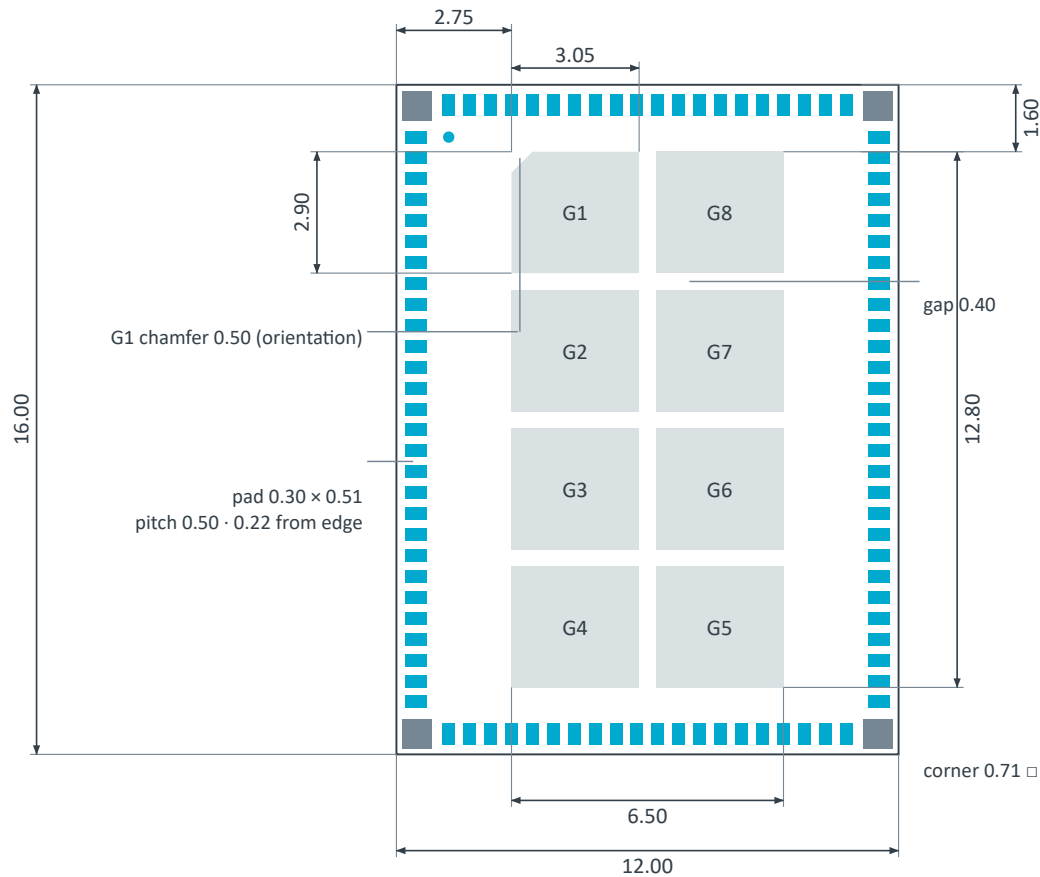


Figure 3: Appearance: top (shield and i.PEX) and bottom (108 pads)

Drawn from the shield-can drawing (2022-11-21), the PCB outline and the bottom-pad manufacturing data; the label is illustrative, the shipped label governs.

5.2 Dimensions and land pattern



Module bottom pads · mm · outline ± 0.08 · general ± 0.10 · height 2.0

Figure 4: Dimensions and pads (mm)

Outline	12.00 × 16.00 mm (± 0.08); height 2.0 mm = PCB 0.8 + shield 1.2
Shield can	10.87 × 14.88 × 1.20 mm, nickel silver $t = 0.2$ mm; i.PEX cut-out at the top right (from 6.72 mm, 2.92 mm deep)
Perimeter pads	96: 28 per side, 20 top and bottom; 0.30 × 0.51 mm (12 × 20 mil), pitch 0.50 mm, outer edge 0.22 mm from the board edge
Corner pads	G9–G12: 0.71 × 0.71 mm, 0.14 mm from the edge; inner spacing 10.29 / 14.29 mm
Centre pads	G1–G8: 3.05 × 2.90 mm each, 0.40 mm gap, 2 × 4; group 6.50 × 12.80 mm, 2.75 mm from the sides and 1.60 mm from top/bottom; 0.50 mm chamfer on G1 marks orientation

Table 8: Mechanical dimensions

Note: Pad sizes are measured from the module bottom-pad manufacturing data (DXF) and agree with the 2024 layout. Use a 1:1 host land pattern (Option A), or extend the perimeter pads outward as in 5.4 for side fillets and inspection.

5.3 Module PCB stack-up

Layer	Name (layout)	Material	Copper	Thickness after lamination	Dk @1 GHz
Solder mask	—	Black solder mask	—	0.020 mm	—
L1	TOP (components, 50 Ω)	Foil + plating	1/3 oz + plating	0.029 mm	—
	Dielectric	PP 1080	—	0.064 mm (2.5 mil)	4.0
L2	L2_GND1 (ground)	Foil + plating	1/3 oz + plating	0.031 mm	—
	Dielectric	PP 1080H	—	0.073 mm (2.88 mil)	3.9
L3	L3_IN2 (signal)	Copper	0.5 oz	0.030 mm	—
	Dielectric	Core	—	0.267 mm (10.5 mil)	4.1
L4	L4_IN3 (signal)	Copper	0.5 oz	0.030 mm	—
	Dielectric	PP 1080H	—	0.073 mm (2.88 mil)	3.9
L5	L5_GND2 (ground)	Foil + plating	1/3 oz + plating	0.031 mm	—
	Dielectric	PP 1080	—	0.064 mm (2.5 mil)	4.0
L6	BOTTOM (LGA pads)	Foil + plating	1/3 oz + plating	0.029 mm	—
Solder mask	—	Black solder mask	—	0.020 mm	—

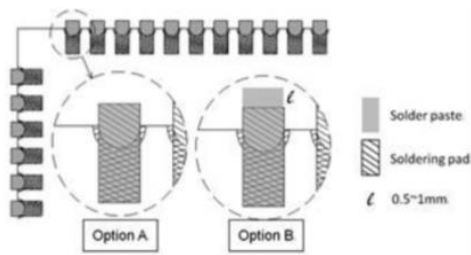
Table 9: PCB stack-up

Construction	6-layer HDI, build-up 1+1+2+1+1; blind vias L1–L2, L1–L3 (laser), buried L2–L5, blind L5–L6; all vias resin-filled and capped (IPC-6012D 3.6.2.11.2 Class 2, via-in-pad)
Material / thickness	Halogen-free FR-4, RoHS; finished 0.8 mm (+0.1 / –0.1)
Finish	ENIG; black solder mask, white legend (top only)
Impedance	L1 single-ended 50 Ω (ref. L2, $\approx$ 3.8 mil); L3 / L4 stripline 50 Ω ($\approx$ 3.3 mil); L1 / L6 differential 90 Ω ($\approx$ 4.5 / 10.2 mil); L3 differential 90 Ω ; $\pm$ 10 %
Process	Hole copper $\geq$ 1 mil, micro-via plating $\geq$ 0.6 mil; drill / layer registration $\leq$ 3 mil; 3×288 °C / 10 s thermal stress; bow / twist $\leq$ 0.5 %; cross-section report per lot
Panel	$6 \times 7 = 42$ pieces, 100 $\times$ 130 mm panel, 0.25 mm routing gap

Table 10: PCB fabrication

Note: Stack-up from the PCB maker's confirmation sheet of 2022-01-21 (6L BUM 1+1+2+1+1, 0.8 mm) and PWB engineering spec R02; the 2024 layout keeps the same layer names and via structure. The PWB spec states 0.5 oz outer / 1 oz inner copper; the maker's sheet states 1/3 oz + plating outer / 0.5 oz inner, which the table follows.

5.4 Stencil and soldering



- Paste apertures as the recommended land pattern (Option A).
- Where inspection (PQC) requires side fillets, extend the perimeter apertures outward by 0.5–1 mm (Option B).
- With a stencil of 0.1 mm or thinner, a locally stepped stencil may be considered; tune apertures to the SMT process.

Figure 5: Perimeter-pad stencil apertures: Option A and Option B

5.5 Host-board layout

- Solder and ground all centre (G1–G8) and corner (G9–G12) pads, with plenty of ground vias beneath for heat spreading.
- Avoid high-speed or sensitive traces on the host surface layer under the module.
- VDD_HV (72, 73) may be paralleled on one supply with local decoupling; decouple FEM_VDD (5) separately.
- Use only the certified antennas in chapter 8 via the i.PEX connector, away from metal and fast traces.
- Do not reuse a Wi-Fi/BT 1216 host design as is (see 4.2).

6 Certification summary

The table lists every certification and conformity document obtained or held by DIVAN TRADING CO., LTD. for the ABR-WM01-M series (i.e. BFi53MLG). The original certificates and reports are kept in the BANFi certification folder _Certifications/BFi53MLG_ABR-WM01-MKE/.

Region / item	Certificate / registration	Holder	Issued / signed by	Date	Basis
USA FCC modular grant	FCC ID 2BDGV-M2X Cert 232181044/AA/00	DIVAN	Kiwa Nederland B.V. (TCB)	2023-12-07	47 CFR Part 15C · DTS · Single Modular
Canada ISED modular certification	IC 31619-M2X Kiwa 242170019/AA/00	DIVAN	Kiwa Nederland B.V. (NL0001, CB-02)	2024-02-06	RSS-247 Ed. 3 · RSS- 102 Iss. 5 · Full modular
Japan specified radio equipment	R 201-230707 Cert 201-230707/00	DIVAN	Kiwa Nederland B.V. (CAB 201)	2023-11-07	Radio Law, Art. 2 (1) item 19 (2.4 GHz wideband low-power data)
Taiwan NCC type approval	CCAJ22Y10181T9 (ABR- WM01-M) CCAJ22Y10180T7 (ABR- WM01-MKE)	DIVAN (label authorisation)	Telecom Technology Center (TTC)	Approved 2022-12-19 Authorised 2023-10-31	LP0002 (2020 ed.) 4.10.1
Bluetooth SIG product listing	Declaration ID D066840 Referenced QDID 188398	DIVAN	Bluetooth SIG Launch Studio	2023-12-21	DV-MLG / DV-MKE
EU CE (RED) radio	Report TERF2309002342E2	DIVAN (applicant)	SGS Taiwan Central RF Lab	2023-10-20	EN 300 328 V2.2.2
EU CE EMC	Report TMHY2309001624YE VoC VTMHY2309001624YEA	DIVAN (applicant)	SGS Taiwan EMC Lab	2023-10-19	EN 301 489-1 / -17 · EN 55032
EU CE RF exposure	Report TESA2309000552ES	DIVAN (applicant)	SGS Taiwan	2023-10-20	EN 62311:2008 / EN IEC 62311:2020
EU CE safety	Report TSSF2309000533L0	DIVAN (applicant)	SGS Taiwan Safety Lab	2023-10-24	IEC 62368-1:2018 · EN IEC 62368- 1:2020+A11:2020
Australia / NZ RCM SDoC	Ref. CF16576_AU-Rev.-01	N136 Pty. Ltd. (authorised agent)	Supplier's declaration	2023-10-30	AS/NZS 4268 · AS/NZS CISPR 32

Region / item	Certificate / registration	Holder	Issued / signed by	Date	Basis
AU/NZ radio / exposure / EMC / safety	TERF2309002342E2 · TESA2309000553ES · TMHY2309001627YE · TSSF2309000534L1	DIVAN (applicant)	SGS Taiwan	2023-10	AS/NZS 4268:2017 · AS/NZS 2772.2:2016 · AS/NZS CISPR 32 · AS/NZS 62368-1:2022
Japan VCCI EMC	Report TMHY2309001626YE	DIVAN (applicant)	SGS Taiwan EMC Lab	2023-10-19	VCCI-CISPR 32:2016 Class B

Table 11: Certification summary

- FCC, ISED, Japan and the Bluetooth listing are in DIVAN's name (FCC / ISED by change of ID, Japan by change of holder).
- Taiwan NCC: DIVAN TRADING CO., LTD. (business ID 22424657) holds a registered authorisation to use the approval labels of both models under Article 15 of the approval regulations, recorded by TTC on 2023-10-31.
- Canadian representative: TianHeng Consulting Inc. (ISED company no. 11802A); letter of attestation and agreement signed 2024-01-17, valid for the product lifetime.
- None of the certificates states an expiry date. The earlier datasheet lists NBTC (Thailand), but no NBTC document in DIVAN's name is in the certification folder, so it is not listed.
- The CE and RCM EMC / safety / radio reports cover ABR-WM01-MKE, ABR-WM01-M and ABR-WM01-MXX (XX = 0–9).

7 Certificates and test-report data

This chapter summarises the certificates and reports; values are copied as printed. Common conditions of the four radio reports: BLE 1M / 2M, GFSK, 2402–2480 MHz (40 channels), test channels 2402 / 2440 (2442) / 2480 MHz; 3.3 Vdc supply; nRF Connect test software; worst case with the highest-gain antenna (INPAQ dipole, 3.31 dBi).

7.1 USA FCC and Canada ISED

FCC grant	Grant of Equipment Authorization · FCC ID 2BDGV-M2X · Cert 232181044/AA/00 · applied 2023-12-05, granted 2023-12-07 · TCB Kiwa Nederland B.V. · grantee DIVAN TRADING CO., LTD. (not transferable)
FCC listing	Equipment class: Digital Transmission System (DTS) · Part 15C · 2402.0–2480.0 MHz · 0.004 W (conducted) · Modular type: Single Modular
FCC grant notes (summary)	Modular approval; power is conducted; sold only to OEM integrators and installed by them; antennas must provide at least 20 cm separation from all persons and must not be co-located or operated with any other antenna or transmitter; end users may not be given the module installation instructions; OEM integrators and end users must be given the transmitter operating conditions for RF exposure compliance.
ISED certificate	Certification No. 31619-M2X · Kiwa 242170019/AA/00 · issued 2024-02-06 · Kiwa (NL0001, CB-02) · test site TW3702 · holder DIVAN (ISED company no. 31619)
ISED listing	Bluetooth device · ABR-WM01-MKE, ABR-WM01-M (HVIN) · RSS-247 Edition 3, RSS-102 Issue 5 · 2402–2480 MHz · emission designator 2M10F1D · 0.004 W · Full modular approval
ISED antennas	Dipole max. 3.31 dBi, chip max. 2.93 dBi, PCB max. 1.31 dBi (2.4 GHz)
ISED reports cited	SGS Taiwan TERF2208001445E2, TESA2208000288ES (2022-10-21)
Canadian representative	TianHeng Consulting Inc. (ISED 11802A, Kanata, ON) · attestation 2024-01-17 · term: product lifetime

Table 12: USA FCC and Canada ISED certificates

The FCC grant itself lists no models or antennas, and the FCC test report is not in the certification folder (its EMC/FCC+IC sub-folder is empty). The Taiwan LP0002 report uses the FCC 15.247 / ANSI C63.10 methods and can serve as a reference (see 7.4).

7.2 Japan — specified radio equipment (Radio Law)

Certificate	Certificate of Radio Equipment in Japan 201-230707/00 · 2023-11-07 · Kiwa Nederland B.V. (CAB ID 201, procedure RD_740) · holder DIVAN
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Models / versions	ABR-WM01-MKE (main), ABR-WM01-M (Annex 3) · HW 1.0.0 / SW 1.0.0
Classification	Article 2, Paragraph 1, Item 19 (2.4 GHz band wideband low-power data communication system)
Rated power	BLE 1M: 3.144 mW (F1D, 40 channels) · BLE 2M: 2.526 mW · declared EIRP 8.285 / 7.335 dBm
Marking	Giteki mark + R 201-230707 (may be split over two lines; electronic labelling allowed)
Report	SGS TERF2310002727E2 (2023-11-02, change of applicant; data from TERF2208001450E2)

Table 13: Japan radio certificate

Test item (2.7 / 3.3 / 3.6 V)	BLE 1M worst	BLE 2M worst	Result
Frequency tolerance	-6.04839 ppm	-6.55201 ppm	PASS
Occupied bandwidth	1.0687 MHz	2.1156 MHz	PASS
Antenna power (max.)	3.1442 mW (4.9751 dBm)	2.5261 mW (4.0245 dBm)	PASS
Power deviation from rated	-35.65 %	-50.38 %	PASS
Unwanted emission 2387–2400 MHz	-29.06 dBm/MHz	-26.98 dBm/MHz	PASS
Unwanted emission 2483.5–2496.5 MHz	-43.65 dBm/MHz	-38.50 dBm/MHz	PASS
Unwanted emission 2496.5 MHz–12.5 GHz	-39.42 dBm/MHz (4803.5 MHz)	-39.33 dBm/MHz	PASS
Receiver secondary emission 1–12.5 GHz	-65.38 dBm/MHz	-59.18 dBm/MHz	PASS
Interference prevention function	Good		PASS

Table 14: Japan radio test data (worst case)

The Japan report prints verdicts only, without numeric limits.

7.3 Bluetooth SIG listing

Declaration ID	D066840 (Launch Studio project "Wireless MCU Module - Bluetooth")
Referenced Qualified Design	QDID 188398
Listing date	2023-12-21
Products	DIVAN Wireless MCU Module - Bluetooth · model DV-MLG (this module) and DV-MKE · "Bluetooth wireless MCU Module for wide temperature range application usage"
Member	DIVAN TRADING CO., LTD.

Table 15: Bluetooth SIG listing

7.4 Taiwan NCC type approval and LP0002 test data

Certificates	Type approval for telecommunications-controlled RF devices · CCAJ22Y10181T9 (ABR-WM01-M, series model, no base board) · CCAJ22Y10180T7 (ABR-WM01-MKE, with base board) · approved 2022-12-19 · RCB Telecom Technology Center
Device name	Wireless microprocessor module
Registered power	ABR-WM01-M: 1M 5.17 dBm, 2M 5.15 dBm · ABR-WM01-MKE: 1M 6.28 dBm, 2M 6.27 dBm
Regulation	Low-power RF device technical regulation LP0002 (2020) 4.10.1; module approval, applicable to any host platform
Label authorisation	DIVAN TRADING CO., LTD. (business ID 22424657), both models; recorded by TTC 2023-10-31, no term stated
Reports	SGS TERF2208001451E2 (LP0002, 258 pages; tested 2022-08-31 to 10-18, issued 2022-11-30) · TERF2208001455E2 (MPE calculation, 2022-10-21)

Table 16: Taiwan NCC type approval

LP0002 test item	Worst measured value	Limit	Result
Peak output power (4.10.1.2)	6.28 dBm (1M, 2480 MHz); 2M 6.27 dBm; average 6.26 dBm	30 dBm	Pass
6 dB bandwidth	min. 0.6937 MHz (1M); 2M 1.121 MHz	≥ 0.5 MHz	Pass
Power spectral density	−9.79 dBm/3 kHz (1M)	8 dBm/3 kHz	Pass
Conducted out-of-band / band edge (4.10.1.5)	2400 MHz: −25.80 dBm (2M)	Reference −20 dB (−14.69 dBm)	Pass
Radiated band edge 2483.5 MHz (restricted band)	Average 54.26 dBμV/m (2M, 2480 MHz, dipole, vertical); peak 62.10 dBμV/m; spot check average 53.58 dBμV/m	AV 54 / PK 74 dBμV/m @3 m	Pass (as reported)
Radiated spurious > 1 GHz	4960 MHz average 52.15 dBμV/m (−1.85 dB); spot check 52.46 (−1.54 dB)	54 dBμV/m	Pass
Radiated spurious < 1 GHz	48.43 MHz 33.45 dBμV/m (−6.55 dB)	40 dBμV/m	Pass
Receiver spurious	48.43 MHz 33.18 dBμV/m (−6.82 dB); 7251 MHz 47.14 dBμV/m (−26.86 dB)	As above	Pass
Whole-system radiated	48.43 MHz 34.39 dBμV/m (−5.61 dB)	40 dBμV/m	Pass
AC line conducted (via test kit, 110 V)	QP 48.47 dBμV @ 0.170 MHz (−16.47 dB)	QP 66–56 dBμV	Pass
MPE (TERF2208001455E2)	2480 MHz, 6.26 dBm + 3.31 dBi, EIRP 9.06 mW, 20 cm: 0.0018 mW/cm ²	1.000 mW/cm ²	Pass

Table 17: LP0002 test data

The radiated band-edge row is copied as printed on page 61 of the report: 2483.5 MHz average 54.26 dBμV/m, limit 54.00, margin column 0.26; the report's overall verdict is "compliant" and the page carries no explanation (data reused from TERF2208001445E2, 2022-10-11). The spot check in the same report gives 53.58 dBμV/m (−0.42 dB). This is the item closest to its limit in the whole report: with a high-gain dipole and BLE 2M at 2480 MHz the band-edge margin is small, so it should be checked first in end-product testing, reducing power on the highest channel if necessary.

7.5 EU RED radio (EN 300 328) and AS/NZS 4268

Report	SGS TERF2309002342E2 (87 pages) · applicant DIVAN · received 2023-09-25, tested 2023-09-26 to 10-05 (spot check for the new applicant), issued 2023-10-20; other items reused from TERF2208001444E2
Standards	ETSI EN 300 328 V2.2.2:2019 (2014/53/EU) · AS/NZS 4268:2017 Row 59 · Radio Equipment Regulations 2017
EUT	ABR-WM01-MKE, ABR-WM01-M · HW 1.0.0 / FW 1.0.0 · 3.3 Vdc · extreme temperatures −40 to +105 °C · declared EIRP 1M 9.56 dBm, 2M 9.54 dBm
Equipment type	Adaptive; EIRP < 10 dBm, so duty cycle, medium utilisation and adaptivity do not apply

Table 18: EN 300 328 / AS/NZS 4268 report

Clause / item	Worst measured value	Limit	Result
4.3.2.2 RF output power (EIRP)	9.56 dBm (1M, 2402 MHz, −40 °C); 8.32 dBm at 25 °C; 7.80 dBm at +105 °C	EN 20 dBm / AS/NZS 36 dBm	Pass
4.3.2.3 Power spectral density	8.24 dBm/MHz (1M)	10 dBm/MHz	Pass
4.3.2.7 Occupied bandwidth (99 %)	1M 1.0738 MHz; 2M 2.1121 MHz; within 2400.97–2481.08 MHz	Inside 2400–2483.5 MHz	Pass
4.3.2.8 OOB unwanted emissions	−33.51 dBm/MHz @ 2399.5 MHz (2M)	−10 dBm/MHz	Pass
4.3.2.9 Spurious emissions (radiated)	4960 MHz −37.36 dBm (−7.36 dB); 95.965 MHz −61.46 dBm (−7.46 dB); spot check −38.23 dBm	−30 dBm (>1 GHz) / −54 dBm	Pass
4.3.2.10 Receiver spurious	267.113 MHz −60.37 dBm (−3.37 dB); 3448 MHz −54.61 dBm (−7.61 dB)	−57 / −47 dBm	Pass
4.3.2.11 Receiver blocking (Category 2)	Blocker −30.69 dBm CW (2380 / 2504 / 2300 / 2584 MHz), PER 0.0 %	PER < 10 %	Pass
4.3.2.4 / 4.3.2.5 / 4.3.2.6 / 4.3.2.12	EIRP < 10 dBm, or no geo-location capability		N/A

Table 19: EN 300 328 test data

Measurement uncertainty: power ±1 dB, PSD ±2.16 dB, radiated ±2.91 dB.

7.6 EMC (CE / RCM / VCCI)

Reports	TMHY2309001624YE (EN 301 489-1 / -17, 36 pages) · TMHY2309001627YE (AS/NZS CISPR 32, 22 pages) · TMHY2309001626YE (VCCI-CISPR 32, 27 pages) · VTMHY2309001624YEA (Verification of Compliance)
Laboratory	SGS Taiwan Ltd. EMC Laboratory (Guishan, Taoyuan) · project TM-2309000431P
Dates	Received 2022-08-23; tested 2022-09-08 to 09-12; issued 2023-10-19 (licensed from 2022 reports TMHY2208001427YE / 1429YE / TMHY2209001679YE)
Standards	EN 301 489-1 V2.2.3 · EN 301 489-17 V3.2.4 · EN 55032:2015+A11:2020 · EN 61000-4-2:2009 · EN IEC 61000-4-3:2020 · AS/NZS CISPR 32:2015+A1:2020 · VCCI-CISPR 32:2016
Class	Class B (all three reports)
Test set-up	3.3 Vdc lab supply; BLE link (phone with nRF Toolbox HRM) or standby; 5 antennas × 7 modes. Worst case: ABR-WM01-M + ABR-ANT-DF01 PCB antenna below 1 GHz, ABR-WM01-MKE + dipole above 1 GHz

Table 20: EMC reports

Test item	Conditions	Worst result (level / limit / margin)	Result
Radiated emission 30 MHz–1 GHz (EN 55032 / AS/NZS CISPR 32)	10 m, QP, horizontal	512.19 MHz: 32.51 / 37.00 dB μ V/m, –4.49 dB	PASS
Radiated emission 30 MHz–1 GHz (VCCI)	10 m, QP, horizontal	512.04 MHz: 32.78 / 37.00 dB μ V/m, –4.22 dB	PASS
Radiated emission 1–6 GHz (EN 55032 / AS/NZS)	3 m, peak, vertical	5760 MHz: 42.35 / 74.00 dB μ V/m, –31.65 dB (peaks also below the 54 average limit)	PASS
Radiated emission 1–6 GHz (VCCI)	3 m, peak, vertical	5915 MHz: 42.63 / 74.00 dB μ V/m, –31.37 dB	PASS
Radiated immunity RS (EN IEC 61000-4-3)	80 MHz–6 GHz, 3 V/m, AM 80 % 1 kHz, four sides H/V	No degradation	PASS (crit. A)
ESD (EN 61000-4-2)	Indirect HCP / VCP ± 2 , ± 4 kV	No degradation; no test points for contact / air discharge (N/A)	PASS (crit. A)
EFT, surge, conducted immunity, dips, conducted emission	DC powered, no wired ports → not applicable (N/A); to be assessed in the end product		N/A

Table 21: EMC test results

7.6.1 Radiated-emission markers (TMHY2309001624YE; 10 m QP below 1 GHz / 3 m peak above 1 GHz)

Horiz. 30–1000 MHz	dBμV/m	Margin	Vert. 30–1000 MHz	dBμV/m	Margin	Vert. 1–6 GHz	dBμV/m	Margin
504.83	31.58	–5.42	169.06	15.24	–14.76	1025	35.88	–34.12
512.19	32.51	–4.49	751.11	25.61	–11.39	1415	35.82	–34.18
922.49	26.14	–10.86	915.38	26.34	–10.66	2200	37.50	–32.50
951.55	26.55	–10.45	931.40	26.37	–10.63	5465	37.50	–36.50
962.33	26.51	–10.49	961.80	26.49	–10.51	5760	42.35	–31.65
990.82	26.45	–10.55	982.94	26.11	–10.89	5845	40.15	–33.85

Table 22: Radiated-emission markers

Measurement uncertainty 4.41 dB (30 MHz–1 GHz) / 4.27 dB (1–6 GHz); uncertainty not included in the decision. The worst margin below 1 GHz is about 4.2–4.5 dB; host-board layout and antenna position will affect the end-product result.

7.7 Safety (IEC / EN / AS/NZS 62368-1)

Reports	TSSF2309000533L0 (IEC 62368-1:2018, EN IEC 62368-1:2020+A11:2020, 50 pages + attachments) · TSSF2309000534L1 (AS/NZS 62368-1:2022, 80 pages)
Laboratory / date	SGS Taiwan Safety Laboratory; issued 2023-10-24; commission testing
Trade mark / models	DIVAN; ABR-WM01-MKE, ABR-WM01-MXX (X = 0–9 or blank)
Rating	3.3 Vdc (no rated current stated)
Classification	Built-in component (for building-in) · instructed / skilled persons · ES1 · Class III · OVC I · pollution degree 2 · Tma 105 °C · IPX0 · altitude ≤ 2000 m · mass ≤ 2.1 g
Energy sources	DC input and all internal circuits ES1; PS class not assigned, to be evaluated in the end product; MS / TS / RS not applicable
Critical component	PCB: V-1 or better, min. 130 °C (UL 94 / UL 796)
Verdict	Complies
Conditions	Built-in module: the relevant tests (PS classification, fire enclosure, insulation, touch temperature, markings, installation instructions) shall be evaluated in the end product; the reports contain no temperature-rise or fault measurements.

Table 23: Safety reports

7.8 RF exposure (EN 62311 / AS/NZS 2772.2)

Report	Standard	Freq.	Distance	Cond. power	Ant. gain	EIRP	Value / limit	Ratio
TESA2309000552ES	EN 62311:2008 / EN IEC 62311:2020	2402 MHz	20 cm	6.5 dBm	3.31 dBi	9.81 dBm (9.57 mW)	2.68 / 61 V/m	0.002
TESA2309000553ES	AS/NZS 2772.2:2016 · ARPANSA RPS S-1	2402 MHz	20 cm	6.5 dBm	3.31 dBi	9.81 dBm (9.57 mW)	0.019 / 10 W/m ²	0.002

Table 24: RF exposure calculation

Both are calculation reports (issued 2023-10-20, reusing TESA2208000289ES / 290ES 2022) with the highest-gain antenna (3.31 dBi dipole) as worst case. The user manual must state a minimum 20 cm separation between users and the antenna.

7.9 Australia / New Zealand RCM supplier's declaration

Document	Supplier's Declaration of Conformity, Ref. CF16576_AU-Rev-01
Supplier	N136 Pty. Ltd. (authorised agent, ABN 81 145 810 206, Traralgon VIC); signed by Gordon Slimmon (Director), 2023-10-30
Models	ABR-WM01-MKE, ABR-WM01-M, ABR-WM01-MXX (XX = 0–9)
Basis	Radiocommunications (EMC) Standard 2017 — TMHY2309001627YE (AS/NZS CISPR 32); Radiocommunications (Short Range Devices) Standard 2014 — TERF2309002342E2 (AS/NZS 4268)
Note	No validity period is printed. The module SDoC does not replace the end product's SDoC; the end product needs its own declaration.

Table 25: AU/NZ RCM supplier's declaration

8 OEM integration and labelling

8.1 End-product marking and integration

Region	End-product marking	Integration conditions
USA	"Contains FCC ID: 2BDGV-M2X" (per FCC KDB 784748 practice; the grant itself prescribes no wording)	Single Modular; sold to and installed by OEM integrators only; antenna at least 20 cm from persons, no co-location / simultaneous operation with other antennas or transmitters; module installation instructions must not be given to end users; RF exposure operating conditions must be provided
Canada	"Contains IC: 31619-M2X"	Full modular; only the antenna types and maximum gains in the certificate annex (dipole 3.31, chip 2.93, PCB 1.31 dBi)
Japan	Giteki mark + "R 201-230707"	Only the antennas listed in the certificate (same three types); mark size as long as it is easily identifiable; electronic labelling allowed
Taiwan	End-product model and "CCAJ22Y10181T9" (ABR-WM01- M) on the product; NCC mark on the package	Only the five antennas in the NCC certificate; changing antenna or hardware requires re-application; before sale, the end product's brand, model and photos must be registered with TTC through the type-approval holder (contact BANFi for assistance); the user manual must carry the LP0002 warning
EU	CE marking declared by the end- product manufacturer under RED 2014/53/EU	The module's EN 300 328 / EN 301 489 / EN 62311 / EN 62368-1 reports may be referenced; the end product must assess its own EMC and safety
AU / NZ	RCM mark (end product)	The end product needs its own SDoC; AS/NZS 4268, CISPR 32, 2772.2 and 62368-1 reports may be referenced
Bluetooth	Bluetooth® logo	The end product must be listed with the Bluetooth SIG as its own product, referencing DIVAN's design (Declaration ID D066840 / QDID 188398)

Table 26: End-product marking and integration conditions

8.2 NCC antenna list (as listed in the type-approval certificate)

Type	Brand	Model	Gain (dBi)
Dipole	INPAQ	RFDPA131010EMAB301	3.31
Dipole	PSA	RFDPA480700SMABX01	2.12
Chip	PSA	RFECA3216060A1T	2.09
Chip	PSA	RFANT3216120A5T	2.93

Type	Brand	Model	Gain (dBi)
PCB	PSA	ABR-ANT-DF01	1.31

Table 27: Antennas listed in the NCC type-approval certificate

The ISED and Japan certificates list antenna types and maximum gains only, without models; the FCC grant lists no antennas (see the filing). The EMC reports name the dipole RFDPA131015IMAB302, which differs from RFDPA131010EMAB301 in the NCC and RF-exposure reports; the report text is quoted as is. Sample labels showing FCC 2A7B5-MX2 / IC 29413-MX2 carry old IDs; use DIVAN's 2BDGV-M2X / 31619-M2X.

9 Legal notices

Specifications are subject to the final released documents; some dimensions and parameters follow the production version. Certification data are taken from the official certificates provided by DIVAN TRADING CO., LTD. and the SGS and Kiwa reports; certification of the end product remains the responsibility of its manufacturer or importer under local law.

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