Declaration of Compliance with NFPA 130 and BSS 7239 for Model “QNV-6024RM” and “QNV-6023R”

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Reported by

HANWHA TECHWIN CO LTD

6, Pangyo-ro 319 beon-gil, Bundang-gu, Seongnam-si,

Gyoenggi-do, 13488, Korea

1. Objective

To declare the compliance with EN 45545-2 for a product designed by **HANWHA TECHWIN CO., LTD**.

2. Reference Standard

NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems
ASTM E162 – Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
ASTM E662 – Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
BSS 7239 – Test Method for Toxic Gas Generation by Materials on Combustion
IEEE 1202 – IEEE Standard for Flame-Propagation Testing of Wire & Cable
ANSI/UL 1685 – Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

3. Product Information

The product under assessment is a network camera designated **"QNV-6024RM"** and **"QNV-6023R"**. This product is made by **HANWHA TECHWIN CO., LTD**.

These products are developed and designed for application in rolling stock. The enclosure (top and bottom cover) is made of aluminum parts. The dome cover consists of a transparent polycarbonate. The products contain the functional components including printed circuit boards, and other miscellaneous materials inside the enclosure. They also have one cable assembly for communication.

The overall dimension of the products is **100mm x 98.3mm with 52mm height**. The total mass of "**QNV-6024RM"** and **"QNV-6023R**" is **299.7g** and **293.6g** respectively.
These products will be installed on the ceiling of rolling stocks. Only the front face will be exposed to a passenger area. While multiple number of the products can be used in one vehicle, each product will be installed separately.
The diagram of "**QNV-6024RM/QNV-6023R**" is shown in **Figure 1**. The breakdown structure of the product with the part list is shown in **Figure 2**. The part list with the information of each mass is shown in **Table 1**. The difference between each model name is the type of cable.
Also, the construction of the products are similar with that or **"XNV-6022RM"**. **Figure 3** details the difference between them.

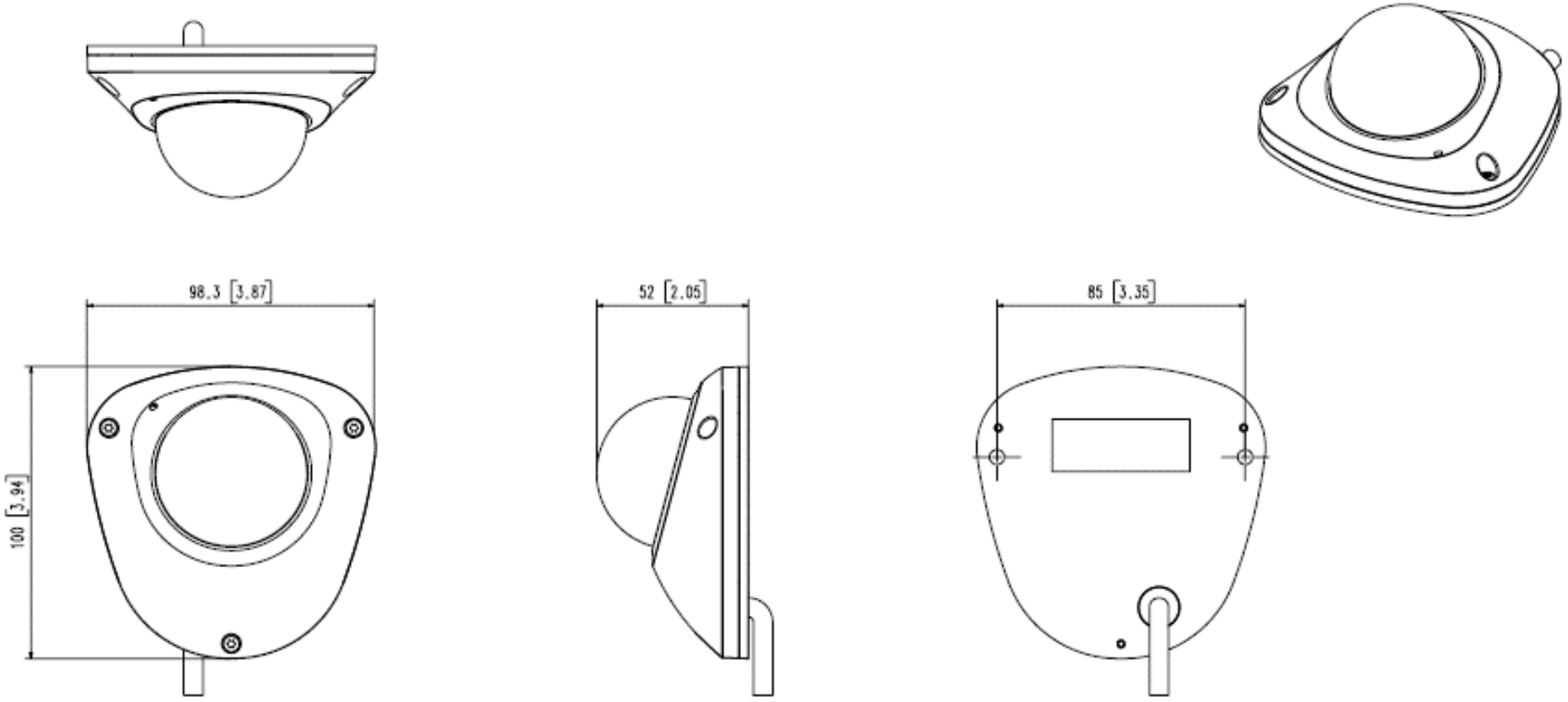


Figure 1: Diagram of "QNV-6024RM/QNV-6023R"

No.	Part Code	Part name	ea
1	AM07-011330A	COVER-FRONT-SCB5005; ADC12, COVER, BLACK	-
2	FC29-007846D	CASE-TOP-W/SENET, SNV-L6014RM, ADC12	1
	FC18-001418A	SCREW-SPECIAL_TORX10_M3_L8; TORX, BH, FP, M3	3
3	HP07-000254A	GASKET-DOME; SILICON, SNV-6013, GRAY	1
4	FC15-002790B	COVER-DOME; PC V2, MIGRATION, TRP, OD52	1
5	FC09-007358A	BRACKET-DOME, SNV-L6014RM, SECC	1
6	FC09-007359B	BRACKET-MODULE-FIXED, XNV-6013M, PC	1
7	FC29-007945A	HOOD-IR-SNV-L6014RM	1
8	FC29-007844A	HOLDER-MODULE-TOP, SNV-L6014RM	1
9	AM06-006919A	ASSY, PCB-SNV-L6013R/L6014RM_LED_CYBRIGH	1
10	EP14-001066	LENS SET-2M_3.6MM_CHI OPT; FIXED	1
	Z6031007302A	WAVE_WASHER_H3	1
	FC18-005110A	SPACER-T0.6-OD15-ID12.1	1
	HP12-000632A	SEALRING-O-S10-SNB6010	1
	AM07-010985B	ASSY, DN MODULE-DC DN_EXPORT	1
11	AM06-009114A	ASSY, PCB-QNV-6023R, 6024RM_SENSOR	1
12	FC29-007845A	HOLDER-MODULE-BOTTOM, SNV-L6014RM	1
13	FC15-005001A	COVER-MIC-RUBBER; SILICON RUBBER	1
14	EP10-001083A	MODULE, ELECTRONIC-WHC6035CW-R50-A28J-510	1
15	FC39-004582B	FRAME-MAIN, QNV-6024RM, PC	1
16	AM06-009108A	ASSY, PCB-QNV-6024RM_MAIN	1
17	FC28-000731A	PAD-THERMAL-45X30X1.5; SILICON RUBBER	1
18	FC29-007843D	CASE-BOTTOM, QNV-6024RM, ADC12	1
19	PM02-001973A	DESIPAK-1G; DESIPAK	2
S1	Z6001055101A	SCREW-MACHINE; 6001-001707, BH, +, M2, L4, ZP	5
S2	Z6003019801A	SCREW-TAPTYPE; 6003-001440, BH, +, B, M2, L4,	5
S3	Z6001042201A	MACHINE SCREW(이붙이WASHER HEAD, M2.6xL4)	2
C1	EP02-004376A	HARNESS-XNV-6013M, WIRE, 4P-4P, 55MM	1
C2	EP02-004260A	HARNESS-XNV-6011; MCX, 30P, 80MM	1
C3	EP02-004693A	HARNESS-QNV-6024RM, 14P-(2P+3P+5P), 580MM	1

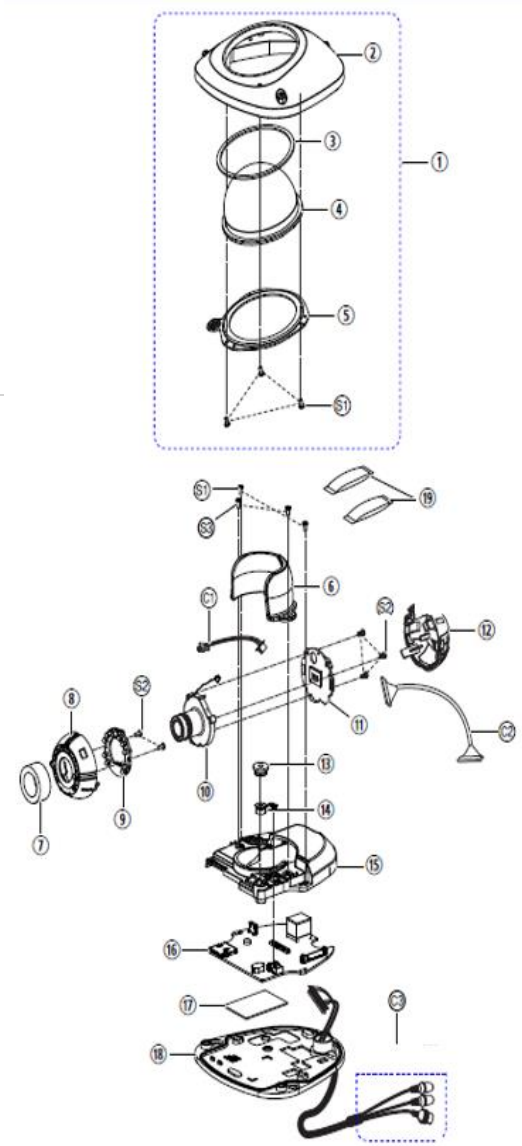
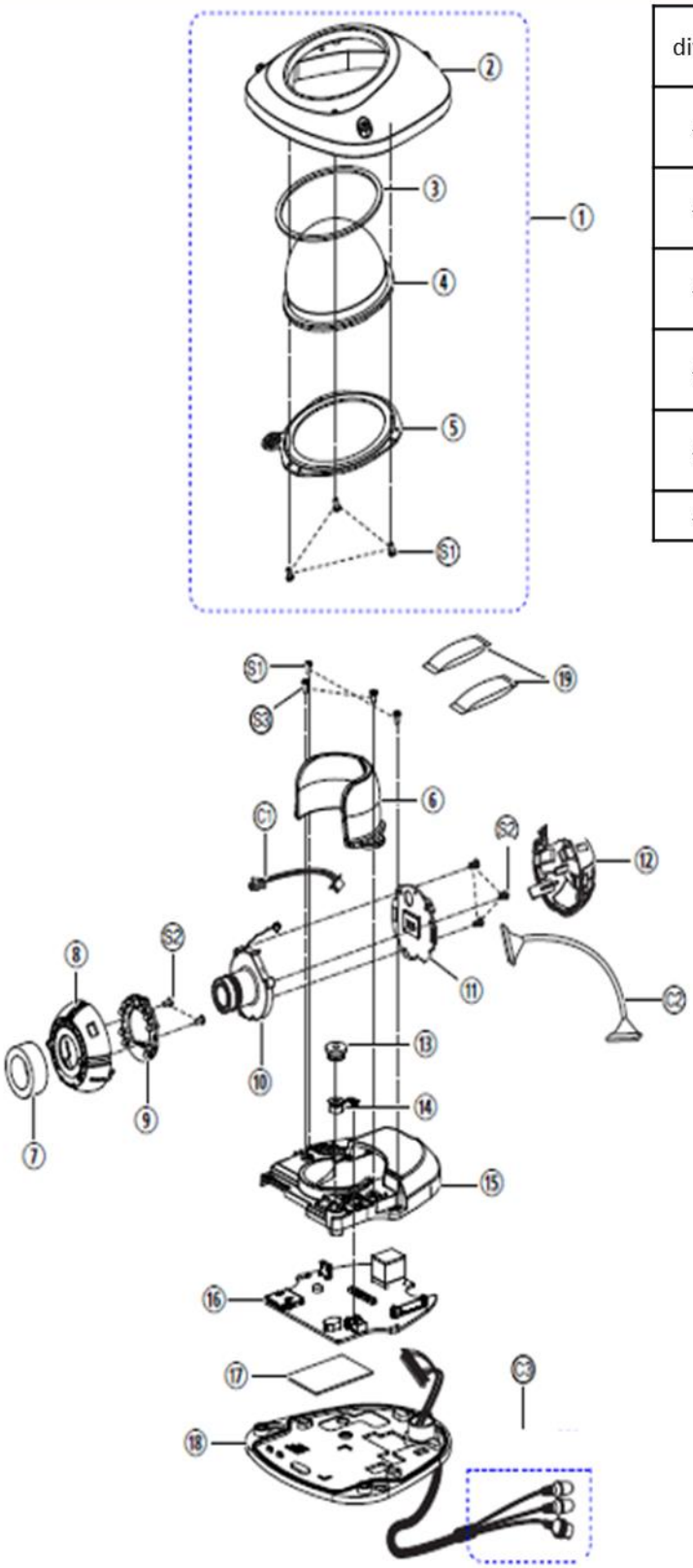


Figure 2: Breakdown Structure of "QNV-6024RM/QNV-6023R" with Part List

No.	Level						Part Code	Part name	QNV-6024RM			QNV-6023R			Meterial type	
	1	2	3	4	5	6			ea	Unit weight (g)	Total weight (g)	ea	Unit weight (g)	Total weight (g)	Type	Details
1	O						AM07-013611A	ASSY, FINAL	1	0	0	1	0	0	-	ASSY
2		O					AM06-009108A	ASSY, PCB-QNV-6024RM_MAIN	1	25.1	25.1	1	25.1	25.1	PCB	PCB
3			O				AM06-009114A	ASSY, PCB-QNV-6023R, 6024RM_SENSOR	1	3.6	3.6	1	3.6	3.6	PCB	PCB
4			O				FC29-007844A	HOLDER-MODULE-TOP, SNV-L6014RM	1	4.0	4.0	1	4.0	4.0	PLASTIC	PC
5			O				FC29-007845A	HOLDER-MODULE-BOTTOM, SNV-L6014RM	1	5.0	5.0	1	5.0	5.0	PLASTIC	PC
6			O				Z6003019801A	SCREW-TAPTYPE; 6003-001440, BH, +, B, M2, L4,	5	0.1	0.5	5	0.1	0.5	METAL	SCREW
7			O				FC29-007945A	HOOD-IR-SNV-L6014RM	1	0.2	0.2	1	0.2	0.2	PLASTIC	PE
8			O				AM07-010985B	ASSY, DN MODULE-DC DN_EXPORT	1	0.0	0.0	1	0.0	0.0	-	ASSY
9				O			FC29-007848C	HOLDER-DN-DC-6H, SNV-L6014RM, PPS	1	4.1	4.1	1	4.1	4.1	PLASTIC	PPS
10				O			FC15-004808A	COVER-DN-DC, SNV-L6014RM, MOLD	1	0.9	0.9	1	0.9	0.9	PLASTIC	PC
11				O			MC11-004183A	GEAR-DN-DC, SNV-L6014RM, POM, MOLD	1	0.1	0.1	1	0.1	0.1	PLASTIC	POM
12				O			MC11-004184A	GEAR-MOTOR-DC, SNV-L6014RM, POM, MOLD	1	0.0	0.0	1	0.0	0.0	PLASTIC	POM
13				O			EP08-002282A	MOTOR, ELECTRIC-DN-DC_VIDE, SNV-L6014RM, DC	1	0.5	0.5	1	0.5	0.5	COMPLEX(ELECTRIC)	MOTOR
16					O		MC11-004182A	GEAR-FILTER, SNV-L6014RM, POM, MOLD	1	0.4	0.4	1	0.4	0.4	PLASTIC	POM
17					O		EP12-000057A	GLASS, OPTICS-0.6T 650NM 8.8X8.2	1	0.1	0.1	1	0.1	0.1	GLASS	GLASS
18					O		EP12-001002A	GLASS, OPTICS-DUMMY GLASS	1	0.1	0.1	1	0.1	0.1	GLASS	GLASS
19				O			FC38-001082A	SPRING, ETC-DN-DC, SNV-L6014RM, STS304	1	0.1	0.1	1	0.1	0.1	METAL	STAINLESS STEEL
25			O				EP14-001066	LENS SET-2M 3.6MM_CH OPT; FIXED	1	4.6	4.6	1	4.6	4.6	COMPLEX	GLASS+PC
26			O				Z6031007302A	WAVE_WASHER_H8	1	0.1	0.1	1	0.1	0.1	METAL	STAINLESS STEEL
27			O				FC18-005110A	SPACER-T0.6-OD15-IDI2.1	1	0.3	0.3	1	0.3	0.3	PLASTIC	PC
28			O				HP12-000632A	SEALRING-O-S10-SNB6010	1	0.1	0.1	1	0.1	0.1	RUBBER	RUBBER
29			O				EP02-004260A	HARNESS-XNV-6011; MCX, 30P, 80MM	1	0.9	0.9	1	0.9	0.9	CABLE	CABLE
30			O				EP02-004376A	HARNESS-XNV-6013M, WIRE, 4P-4P, 55MM	1	0.6	0.6	1	0.6	0.6	CABLE	CABLE
31			O				AM06-006919A	ASSY, PCB-SNV-L6013R/L6014RM_LED_CYBRIGH	1	2.4	2.4	1	2.4	2.4	PCB	PCB
32			O				AM07-011330A	ASSY, CASE-TOP-WISENET, SNV-L6014RM-TEMP	1	0.0	0.0	1	0.0	0.0	-	ASSY
33				O			FC29-007846D	CASE-TOP-WISENET, SNV-L6014RM, ADC12	1	86.6	86.6	1	86.6	86.6	METAL	ALUMINUM-SPRAY
34				O			FC15-002790B	COVER-DOME; PC V2, MIGRATION, TRP, OD52	1	12.8	12.8	1	12.8	12.8	PLASTIC	PC
35				O			HP07-000254A	GASKET-DOME; SILICON, SNV-6013, GRAY	1	0.6	0.6	1	0.6	0.6	RUBBER	RUBBER
36				O			FC09-007358A	BRACKET-DOME, SNV-L6014RM, SECC	1	11.1	11.1	1	11.1	11.1	METAL	STEEL
37				O			FC36-001063A	SHEET-GORE-VE90308-3.6X7.6	1	0.1	0.1	0	0.1	0.0	ETC	TAPE
38							Z6001055101A	SCREW-MACHINE; 6001-001707, BH, +, M2, L4, ZP	3	0.1	0.3	3	0.1	0.3	METAL	SCREW
39				O			FC18-001418A	SCREW-SPECIAL_TORX10_M3_L8; TORX, BH, FP, M3	3	0.5	1.5	3	0.5	1.5	METAL	SCREW
40				O			HP07-001123A	GASKET-TOP, SNV-L6014RM, SILICON RUBBER	1	1.3	1.3	1	1.3	1.3	RUBBER	RUBBER
41			O				AM07-007537D	ASSY, CASE-BOTTOM, QNV-6024RM	1	0.0	0.0	1	0.0	0.0	-	ASSY
42				O			FC29-007843D	CASE-BOTTOM, QNV-6024RM, ADC12	1	47.5	47.5	1	47.5	47.5	METAL	ALUMINUM-SPRAY
43				O			EP02-004693A	HARNESS-QNV-6024RM, 14P-(2P+3P+5P), 580MM	1	59.1	59.1				CABLE	CABLE
							EP02-004692A	HARNESS-QNV-6023R, WIRE, 14P-(2P+9P), 580MM				1	53.6	53.6		
44		O					EP10-001083A	MODULE, ELECTRONIC-WHO6035CW-R50-A28J-510	1	0.4	0.4	0	0.4	0.0	COMPLEX(ELECTRIC)	MIC
45		O					FC15-005001A	COVER-MIC-RUBBER; SILICON RUBBER	1	0.2	0.2	0	0.2	0.0	RUBBER	RUBBER
46		O					FC28-000731A	PAD-THERMAL-45X30X1.5; SILICON RUBBER	1	3.6	3.6	1	3.6	3.6	RUBBER	ETC
47		O					FC39-004582B	FRAME-MAIN, QNV-6024RM, PC	1	12.5	12.5	1	12.5	12.5	PLASTIC	PC
48		O					Z6001055101A	SCREW-MACHINE; 6001-001707, BH, +, M2, L4, ZP	2	0.1	0.2	2	0.1	0.2	METAL	SCREW
49		O					FC09-007359B	BRACKET-MODULE-FIXED, XNV-6013M, PC	1	5.5	5.5	1	5.5	5.5	PLASTIC	PC
50		O					Z6001042201A	MACHINE SCREW(이붙이WASHER HEAD, M2.6xL4)	2	0.3	0.6	2	0.3	0.6	METAL	SCREW
51		O					PM02-001973A	DESIPAK-1G; DESIPAK	2	1.0	2.0	2	1.0	2.0	ETC	MINERAL
53		O					PT03-003217B	LABEL-RATING-CAMS-QR-CE, EAC, RCM, 10; WHIT	1	0.1	0.1	1	0.1	0.1	PLASTIC	PET
									TOTAL		299.7	TOTAL		293.5		

Table 1: Part List of "QNV-6024RM/QNV-6023R" with Information of Each Mass



division	Old model (XNV-6022RM / 6022R) Contrast change item
#15	Material is not changed, only some shapes are changed
#17	Material is not changed, only some shapes are changed
#18	Material is not changed, only some shapes are changed
#11	PCB Material is not changed, Changing Patterns and Mounting Parts
#16	PCB Material is not changed, Changing Patterns and Mounting Parts
#C3	Change cable to shield type

Figure 3: Construction difference between "QNV-6024RM/QNV-6023R" and "XNV-6022RM"

The products establish a network connection through the cable assembly shown in **Figure 4 and 5**.

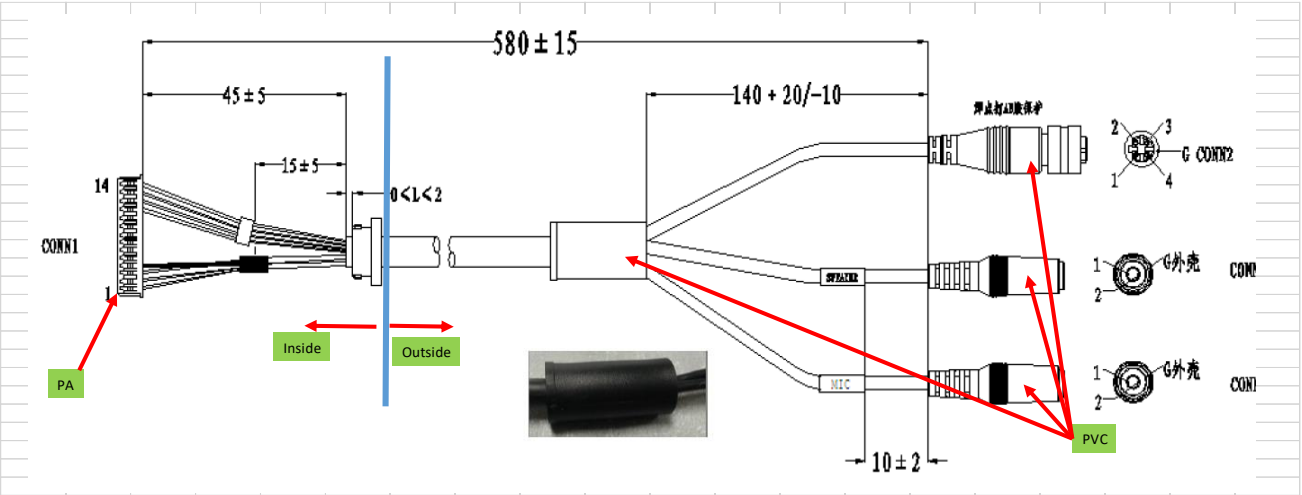


Figure 4: Detail of Cable Assembly for "QNV-6024RM"

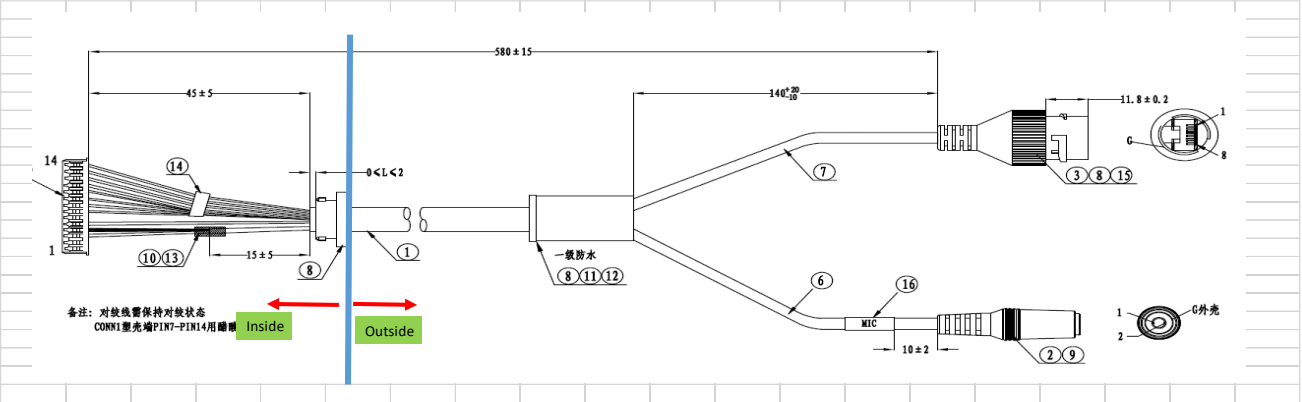


Figure 5: Detail of Cable Assembly for "QNV-6023R"

4. Assessment

In accordance with Chapter 8 of NFPA 130 ("Vehicles"), assessment was conducted to determine which parts/materials should be subject to flammability testing, what kind of testing should be done for each part/material, and whether the test results pass the criteria stipulated by the standard.

1) Dome Cover:

Dome cover is made of polycarbonate (HF1130R/SABIC), which is combustible, and therefore should be assessed.

Although NFPA 130 does not specify any requirement for this kind of part, the application can be considered as equivalent to "Light diffuser", because the product will be installed on the ceiling, and the dome cover part is made of transparent plastic. According to Table 8.4.1 of NFPA 130, ASTM E162 (Surface flammability testing) and ASTM E662 (smoke emission testing) were selected to demonstrate the compliance with the standard requirement. Refer to the following extract from the standard;

Light diffusers, windows, and transparent plastic windscreens[b,i]	ASTM E162	$I_s \leq 100$
	ASTM E662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200

Also, based on the general practice in the North-American railway industry, toxicity testing was conducted in accordance with **BSS 7239** in addition to the surface flammability (ASTM E162) and smoke emission (ASTM E662) testing. The typical practice in the aircraft industry was used as the criteria of toxicity. Refer to the following table;

Table 2: Measured gas types and typical acceptance criteria

Gas Type	Acceptance Criteria
CO	≤ 3500 ppm
HCN	≤ 150 ppm
HF	≤ 200 ppm
HCl	≤ 500 ppm
SO2	≤ 100 ppm
NO2	≤ 100 ppm

The test results are summarized in **Table 3**. For more detail, refer to the test reports issued by Chemitox, SGS Govmark and Herb Curry, all of which are ISO 17025 accredited for the relevant testing (**Appendix 1**).

Table 3: Test results for Painting

Test Parameter	Test Results	Evaluation	Report Number
Is	5*	Compliant**	190046-RP (Chemitox)
Ds (1.5)	1 in flaming mode 0 in non-flaming mode	Compliant	3-30423-0 (SGS Govmark)
Ds (4.0)	64 in flaming mode 1 in non-flaming mode	Compliant	3-30423-0 (SGS Govmark)
Toxicity	Emission of all gases within acceptance criteria in both flaming and non-flaming mode	Compliant	IB19010 (Herb Curry)

*: Per the client's request, in each testing three sheets were lined up to make the dimension required by the standard.

**: Since the specimens exhibited dripping of flaming material due to melting, no formal radiant panel index shall be reported per ASTM E162 Clause 11.11, and the Is value is only for reference purpose. However, according to the footnotes relevant to the product category of light diffuser, such a behavior is considered acceptable only for this category.

Therefore, the material used for the dome cover is considered as complying with the requirements of NFPA 130.

2) Coating of aluminum enclosure:

The outer cover and cabinet are coated by certain organic painting. See **Table 4** for more detail;

Table 4: Detail of Painting

Part Name	CASE-TOP, SNV-L6014RM;ADC12
Specification of Aluminum Plate	Thickness: 2mm
Specification of Coating	<Under coat> 821KA-WJS-1193 (AKZO Nobel) Color: White <Top coat> 822KA-WJS-8635 (AKZO Nobel) Color: Ivory Thickness: 20-25 um in total

This part can be considered as "component box". According to Table 8.4.1 of NFPA 130, ASTM E162 (Surface flammability testing) and ASTM E662 (smoke emission testing) were selected to demonstrate the compliance with the standard requirement. Refer to the following extract from the standard;

Table 8.4.1 Fire Test Procedures and Performance Criteria for Materials and Assemblies

Category	Function of Material	Test Method	Performance Criteria
Cushioning	All individual flexible cushioning materials used in seat cushions, mattresses, mattress pads, armrests, crash pads, and grab rail padding [a–e]	ASTM D 3675	$I_s \leq 25$
		ASTM E 662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 175
Fabrics	Seat upholstery, mattress ticking and covers, curtains, draperies, window shades, and woven seat cushion suspensions[a–c, f–h]	14 CFR 25, Appendix F, Part I (vertical test)	Flame time ≤ 10 sec Burn length ≤ 6 in.
		ASTM E 662	D_s (4.0) ≤ 200
Other vehicle components	Seat and mattress frames, wall and ceiling lining and panels, seat and toilet shrouds, toilet seats, trays and other tables, partitions, shelves, opaque windscreens, combustible signage, end caps, roof housings, articulation bellows, exterior shells, nonmetallic skirts, and component boxes and covers[a,b,i–k]	ASTM E 162	$I_s \leq 35$
		ASTM E 662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
	Thermal and acoustical insulation[a,b]	ASTM E 162	$I_s \leq 25$
		ASTM E 662	D_s (4.0) ≤ 100

Also, based on the general practice in the North-American railway industry, toxicity testing was conducted in accordance with **BSS 7239** in addition to the surface flammability (ASTM E162) and smoke emission (ASTM E662) testing. The typical practice in the aircraft industry was used as the criteria of toxicity. Refer to **Table 2**.

The test results are summarized in **Table 5**. For more detail, refer to the test reports issued by Chemitox, SGS Govmark and Herb Curry, all of which are ISO 17025 accredited for the relevant testing (**Appendix 2**).

Table 5: Test results for Painting

Test Parameter	Test Results	Evaluation	Report Number
Is	0	Compliant	190080-RP (Chemitox)
Ds (1.5)	0 in flaming mode 0 in non-flaming mode	Compliant	3-30423-0 (SGS Govmark)
Ds (4.0)	7 in flaming mode 0 in non-flaming mode	Compliant	3-30423-0 (SGS Govmark)
Toxicity	Emission of all gases within acceptance criteria in both flaming and non-flaming mode	Compliant	IB19011 (Herb Curry)

Therefore, the coating material is considered as complying with the requirements of NFPA 130.

3) Cable Assembly:

NFPA 130 requires all cables to be compliant with the following requirements;

> **8.6.7.1.1.1** All wires and cables shall comply with the FT4/ IEEE 1202 exposure requirements for cable char height and with ANSI/UL 1685 for total smoke released and peak smoke release rate.

In this project, the cable assembly was not tested because the client stated that they cannot prepare the required length of cable for both FT4/IEEE 1202 and ANSI/UL 1685. Therefore, **the compliance of the cable has NOT been demonstrated in this assessment report**.

However, there would still be a possibility that this cable can be used in railway vehicles by referring to **Clause 8.4.2 of NFPA 130**. See also the following extract from the standard;

> **8.4.2*** Materials intended for use in a limited area of the vehicle and not meeting the requirements of Table 8.4.1 shall be permitted only after an appropriate fire hazard analysis establishes, within the limits of precision, that the material produces a contribution to fire hazard equal to or less than a material meeting the appropriate criteria of Table 8.4.1, where the alternative material is used in the same location to fulfill a function similar to the candidate material.

For the product under assessment, the cable can be considered as producing very low contribution to fire hazard based on the following assumptions;

- While multiple number of the products can be used in one vehicle, each product will be installed separately.
- The total number of the products installed in a vehicle will be quite limited according to the purpose of the product's application (i.e. a specific area within railway vehicles is surveilled by one product).
- The mass of the cable assembly is very small (57g per the information in **Table 1**).
- The cable assembly itself will not be exposed to passenger area (i.e. it will be hidden behind ceiling

panel).

With those taken into consideration, it is thought that there would be cases where users of the product accept the use of this cable assembly not demonstrating the compliance.

4) Other miscellaneous combustible materials:

There are other miscellaneous materials which are combustible. However, all those materials are very small (i.e. surface area less than 100cm^2), and except for the labels, are covered by the already assessed compliant parts. This means that they are considered as not critical and not likely to contributing to development of fire. For the labels, although they are exposed, the testing can be omitted by applying the following exception stated in NFPA 130;

> **8.4.1.9** Combustible operational and safety signage shall not be required to meet flame spread or smoke emission requirements if the combustible mass of a single sign does not exceed 500 g (1.1 lb) and the aggregate area of combustible signage does not exceed 1 ft^2 per foot of car length.

Therefore, those materials can be considered as complying with the requirement of NFPA 130 without any additional testing and evaluation, assuming an appropriate fire hazard analysis demonstrates that they will not contribute materially to fire growth in end use configuration.

5. Verification of compliance with NFPA 130 and BSS 7239

According to the assessment described in Item 5, the compliance with NFPA 130 for the relevant product has been verified **only in case where a fire hazard analysis based on actual end use application allows the cable assembly not to be evaluated**.

With regards to BSS 7239, it has been verified that the concentration of all emitted gases are within the acceptance criteria shown in **Table 2** in both flaming and non-flaming mode.

IMPORTANT NOTE: the acceptance criteria can vary depending on customers' specifications. In this report, verification has been conducted only based on the criteria typically used in the aerospace industry.

Appendix 1
Test Report of Dome Cover Material

Appendix 2
Test Report of Coating