

Test Report

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

Test result: The test item - **passed** - and complies with the listed standards.

Applicant

Mitsubishi Electric Corporation Sanda Works

Manufacturer

Mitsubishi Electric Corporation

Test Item

R1LOW-R-SBM

Electromagnetic Compatibility Testing according to:

47 CFR Part 15

Radio frequency devices,
Subpart B – Unintentional Radiators
(§15.107, §15.109)

ICES-003 Issue 7

Information Technology Equipment
(including Digital Apparatus)
(3.1.1, 3.2.2)

Tested by
(name, function, signature)

Frank von Ehren
Lab Manager EMC



signature

Approved by
(name, function, signature)

Florian Schmidt
Head of Department EMC



signature

Applicant and Test item details	
Applicant	<i>Mitsubishi Electric Corporation Sanda Works 2-3-33, Miwa, Sanda-city, Hyogo 669-1513 Japan Phone: +81 79 559 4813- Fax: ---</i>
Manufacturer	<i>Mitsubishi Electric Corporation 2-3-33, Miwa, Sanda-city, Hyogo 669-1513 Japan Phone: +81 79 559 4813- Fax: ---</i>
Test item description	Automotive Display Audio
Model/Type reference	R1LOW-R-SBM

Disclaimer and Notes

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Within this test report, a ☒ point / ☐ comma is used as a decimal separator.
If otherwise, a detailed note is added adjoined to its use.

Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor $k=2$.

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2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	IBL-Lab GmbH Heinrich-Hertz-Allee 7 66386 Sankt Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: www.ib-lenhardt.de E-Mail: info@ib-lenhardt.de
Accreditation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkKS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: - Electromagnetic Compatibility D-PL-21375-01-02 - Electromagnetic Compatibility and Telecommunication (FCC requirements) D-PL-21375-01-03 Website DAkKS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkKS) is also a signatory to the ILAC Mutual Recognition Arrangement
Testing location	IBL-Lab GmbH Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2021-10-04
Start – End of tests	2021-10-11 – 2021-11-05

2.2 Possible test case verdicts

Test sample meets the requirements	passed
Test sample does not meet the requirements	failed
Test case does not apply to the test sample	n/a (not applicable)
Test case not performed	n/p (not performed)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and interpretations

No appropriate opinions or interpretations according ISO/IEC 17025:2017.

2.5 Revision History

-0 Initial Version

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions

Temperature	20°C ± 5°C (see below)
Relative humidity	25-75% r.H. (see below)
Barometric Pressure	860-1060 mbar

4 TEST STANDARDS AND REFERENCES

Test standard (accredited)	Description
47 CFR Part 15	Radio frequency devices, Subpart B – Unintentional Radiators (§15.107, §15.109)
ICES-003 Issue 7	Information Technology Equipment (including Digital Apparatus) (3.1.1, 3.2.2)

Reference	Description
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

5 SUMMARY OF TEST RESULTS

Test specification

FCC 47 CFR Part 15
ICES-003 Issue 7

Clause	Requirement / Test case	Chapter	Test Conditions	Result / Remark	Verdict
FCC: §15.107 ICES: 3.2.2	Conducted limits	8.1	normal	Class B	n/a
FCC: §15.109 ICES: 3.2.2	Radiated emission limits	8.2	normal	Class B	passed

Comments and observations

6 EQUIPMENT UNDER TEST (EUT)

6.1 EUT A

6.1.1 Product description*

Test item*	Automotive Display Audio																		
Function overview*																			
	Ele-Variant	Mecha-Variant	ID #	Model Name	DDR*1)			UFS*2)			SXM*3)	DAB	FM2	2nd USB	Ethernet	Digital RVCs	Analog RVC*4)	B CAN Term.	C CAN Term.
	30	SBX	28	R1LOW-R-SBM	4GB	105	Micron	32GB	105	Micron	X	-	-	-	X	2	1	X	X
*1) Main Memory																			
*2) Universal Flash Storage																			
*3) SiriusXM																			
*4) Rear View Camera																			

*: as declared by applicant

6.1.2 Description of test item

Model name*	R1LOW-R-SBM
EUT status*	PrePV
Serial number*	65107
Control number*	28
PCB identifier*	NJ00193612
Hardware status*	NR-0C-R-DV
Software status*	Android 10

*: as declared by applicant

6.1.3 Technical data of test item

Operational frequency band*	Bluetooth and Bluetooth LE: 2402 - 2480 MHz Car radio: AM: 531~1611 kHz FM: 87.5~108.0 MHz Sirius-XM: 2320-2345MHz GPS/GLONASS/BeiDou/Galileo: GPS: 1575.42 MHz GLONASS: 1597.5515~1605.886 MHz BeiDou: 1559.052~1563.144 MHz Galileo: 1575.42 MHz WLAN 2.4 GHz band: 2412 - 2472 MHz WLAN 5 GHz band: 5180 - 5240 MHz 5260 - 5320 MHz 5500 - 5720 MHz 5745 - 5825 MHz		
Power supply*	battery powered 9 V – 16.5 V		
Nominal supply voltage*	DC 12.6 V		
Ports*	Classification*	Direction*	Length*
	DC mains	input	> 3m
	Signal/control (vehicle cable harness)	in/output	> 3m
	Signal/control (digital RVC)	input	> 3m
	Signal/control (analog RVC)	input	> 3m
	Signal/control (USB)	in/output	> 3m
	Signal/control (HDMI)	in/output	> 3m
	Wired network, shielded	input	> 3m
	Antenna (FM/AM)	input	> 3m
	Antenna (FM2)	input	> 3m
	Antenna (GNSS)	input	> 3m
	Antenna (WIFI)	in/output	> 3m

*: as declared by applicant

6.1.4 Operation Modes during test

Operation mode 1 (op.1)	Active RVC and continuous reception of a 400 Hz sine wave tone sent by a paired smartphone over FM radio.
Operation mode 2 (op.2)	Active RVC; continuous reception of a 400 Hz sine wave tone sent by a plugged media player over USB; unused ports terminated; WLAN, BT idle

6.2 EUT B

6.2.1 Product description*

Test item*	Automotive Display Audio																		
Function overview*																			
	Ele-Variant	Mecha-Variant	ID #	Model Name	DDR*1)			UFS*2)			SXM*3)	DAB	FM2	2nd USB	Ethernet	Digital RVCs	Analog RVC*4)	B CAN Term.	C CAN Term.
	31	SBX	33	R1LOW-R-SBM	4GB	105	Micron	32GB	105	Micron	X	-	-	X	-	1	1	X	X
*1) Main Memory																			
*2) Universal Flash Storage																			
*3) SiriusXM																			
*4) Rear View Camera																			

*: as declared by applicant

6.2.2 Description of test item

Model name*	R1LOW-R-SBM
EUT status*	PrePV
Serial number*	66605
Control number*	33
PCB identifier*	NJ00193612
Hardware status*	NR-0C-R-DV
Software status*	Android 10

*: as declared by applicant

6.2.3 Technical data of test item			
Operational frequency band*	Bluetooth and Bluetooth LE: 2402 - 2480 MHz		
	Car radio: AM: 531~1611 kHz FM: 87.5~108.0 MHz Sirius-XM: 2320-2345MHz GPS/GLONASS/BeiDou/Galileo: GPS: 1575.42 MHz GLONASS: 1597.5515~1605.886 MHz BeiDou: 1559.052~1563.144 MHz Galileo: 1575.42 MHz WLAN 2.4 GHz band: 2412 - 2472 MHz WLAN 5 GHz band: 5180 - 5240 MHz 5260 - 5320 MHz 5500 - 5720 MHz 5745 - 5825 MHz		
Power supply*	battery powered 9 V – 16.5 V		
Nominal supply voltage*	DC 12.6 V		
Ports*	Classification*	Direction*	Length*
	DC mains	input	> 3m
	Signal/control (vehicle cable harness)	in/output	> 3m
	Signal/control (digital RVC)	input	> 3m
	Signal/control (analog RVC)	input	> 3m
	Signal/control (USB)	in/output	> 3m
	Signal/control (HDMI)	in/output	> 3m
	Antenna (FM/AM)	input	> 3m
	Antenna (GNSS)	input	> 3m
	Antenna (WIFI)	in/output	> 3m

*: as declared by applicant

6.2.4 Operation Modes during test	
Operation mode 1 (op.1)	Active RVC and continuous reception of a 400 Hz sine wave tone sent by a paired smartphone over FM radio.
Operation mode 2 (op.2)	Active RVC; continuous reception of a 400 Hz sine wave tone sent by a plugged media player over USB; unused ports terminated; WLAN, BT idle

6.3 EUT C

6.3.1 Product description*

Test item*	Automotive Display Audio																		
Function overview*																			
	Ele-Variant	Mecha-Variant	ID #	Model Name	DDR*1)			UFS*2)			SXM*3)	DAB	FM2	2nd USB	Ethernet	Digital RVCs	Analog RVC*4)	B CAN Term.	C CAN Term.
	60	SBX	39	R1LOW-R-SBM	4GB	105	Samsung	32GB	105	Samsung	-	X	X	X	-	1	1	X	X
*1) Main Memory																			
*2) Universal Flash Storage																			
*3) SiriusXM																			
*4) Rear View Camera																			

*: as declared by applicant

6.3.2 Description of test item

Model name*	R1LOW-R-SBM
EUT status*	PrePV
Serial number*	65314
Control number*	39
PCB identifier*	NJ00193612
Hardware status*	NR-0C-R-DV
Software status*	Android 10

*: as declared by applicant

6.3.3 Technical data of test item

Operational frequency band*	Bluetooth and Bluetooth LE: 2402 - 2480 MHz Car radio: AM: 531~1611 kHz FM: 87.5~108.0 MHz DAB: 174.928~239.200 MHz GPS/GLONASS/BeiDou/Galileo: GPS: 1575.42 MHz GLONASS: 1597.5515~1605.886 MHz BeiDou: 1559.052~1563.144 MHz Galileo: 1575.42 MHz WLAN 2.4 GHz band: 2412 - 2472 MHz WLAN 5 GHz band: 5180 - 5240 MHz 5260 - 5320 MHz 5500 - 5720 MHz 5745 - 5825 MHz		
Power supply*	battery powered 9 V – 16.5 V		
Nominal supply voltage*	DC 12.6 V		
Ports*	Classification*	Direction*	Length*
	DC mains	input	> 3m
	Signal/control (vehicle cable harness)	in/output	> 3m
	Signal/control (digital RVC)	input	> 3m
	Signal/control (analog RVC)	input	> 3m
	Signal/control (USB)	in/output	> 3m
	Signal/control (HDMI)	in/output	> 3m
	Antenna (FM/AM)	input	> 3m
	Antenna (FM2)	input	> 3m
	Antenna (DAB)	input	> 3m
	Antenna (GNSS)	input	> 3m
	Antenna (WIFI)	in/output	> 3m

*: as declared by applicant

6.3.4 Operation Modes during test

Operation mode 1 (op.1)	Active RVC and continuous reception of a 400 Hz sine wave tone sent by a paired smartphone over FM radio.
Operation mode 2 (op.2)	Active RVC; continuous reception of a 400 Hz sine wave tone sent by a plugged media player over USB; unused ports terminated; WLAN, BT idle

6.4 EUT D

6.4.1 Product description*

Test item*	Automotive Display Audio																		
Function overview*																			
	Ele-Variant	Mecha-Variant	ID #	Model Name	DDR*1)			UFS*2)			SXM*3)	DAB	FM2	2nd USB	Ethernet	Digital RVCs	Analog RVC*4)	B CAN Term.	C CAN Term.
	40	SBX	43	R1LOW-R-SBM	4GB	105	Micron	32GB	105	Micron	-	-	-	-	X	2	1	X	X
*1) Main Memory																			
*2) Universal Flash Storage																			
*3) SiriusXM																			
*4) Rear View Camera																			

*: as declared by applicant

6.4.2 Description of test item

Model name*	R1LOW-R-SBM
EUT status*	PrePV
Serial number*	66704
Control number*	43
PCB identifier*	NJ00193612
Hardware status*	NR-0C-R-DV
Software status*	Android 10

*: as declared by applicant

6.4.3 Technical data of test item			
Operational frequency band*	Bluetooth and Bluetooth LE: 2402 - 2480 MHz		
	Car radio: AM: 531~1611 kHz FM: 87.5~108.0 MHz GPS/GLONASS/BeiDou/Galileo: GPS: 1575.42 MHz GLONASS: 1597.5515~1605.886 MHz BeiDou: 1559.052~1563.144 MHz Galileo: 1575.42 MHz WLAN 2.4 GHz band: 2412 - 2472 MHz WLAN 5 GHz band: 5180 - 5240 MHz 5260 - 5320 MHz 5500 - 5720 MHz 5745 - 5825 MHz		
Power supply*	battery powered 9 V – 16.5 V		
Nominal supply voltage*	DC 12.6 V		
Ports*	Classification*	Direction*	Length*
	DC mains	input	> 3m
	Signal/control (vehicle cable harness)	in/output	> 3m
	Signal/control (digital RVC)	input	> 3m
	Signal/control (analog RVC)	input	> 3m
	Signal/control (USB)	in/output	> 3m
	Signal/control (HDMI)	in/output	> 3m
	Antenna (FM/AM)	input	> 3m
	Wired network, shielded	in/output	> 3m
	Antenna (GNSS)	input	> 3m
	Antenna (WIFI)	in/output	> 3m

*: as declared by applicant

6.4.4 Operation Modes during test	
Operation mode 1 (op.1)	Active RVC and continuous reception of a 400 Hz sine wave tone sent by a paired smartphone over FM radio.
Operation mode 2 (op.2)	Active RVC; continuous reception of a 400 Hz sine wave tone sent by a plugged media player over USB; unused ports terminated; WLAN, BT idle

6.5 EUT E

6.5.1 Product description*

Test item*	Automotive Display Audio																				
Function overview*	Ele-Variant		Mecha-Variant	ID #	Model Name		DDR*1)			UFS*2)			SXM*3)	DAB	FM2	2nd USB	Ethernet	Digital RVCs	Analog RVC*4)	B CAN Term.	C CAN Term.
	41	SBX	48	R1LOW-R-SBM	6GB	105	Samsung	64GB	105	Samsung	-	-	-	X	-	1	1	X	X		
	*1) Main Memory *2) Universal Flash Storage *3) SiriusXM *4) Rear View Camera																				

*: as declared by applicant

6.5.2 Description of test item

Model name*	R1LOW-R-SBM
EUT status*	PrePV
Serial number*	66804
Control number*	48
PCB identifier*	NJ00193612
Hardware status*	NR-0C-R-DV
Software status*	Android 10

*: as declared by applicant

6.5.3 Technical data of test item			
Operational frequency band*	Bluetooth and Bluetooth LE: 2402 - 2480 MHz		
	Car radio: AM: 531~1611 kHz FM: 87.5~108.0 MHz GPS/GLONASS/BeiDou/Galileo: GPS: 1575.42 MHz GLONASS: 1597.5515~1605.886 MHz BeiDou: 1559.052~1563.144 MHz Galileo: 1575.42 MHz WLAN 2.4 GHz band: 2412 - 2472 MHz WLAN 5 GHz band: 5180 - 5240 MHz 5260 - 5320 MHz 5500 - 5720 MHz 5745 - 5825 MHz		
Power supply*	battery powered 9 V – 16.5 V		
Nominal supply voltage*	DC 12.6 V		
Ports*	Classification*	Direction*	Length*
	DC mains	input	> 3m
	Signal/control (vehicle cable harness)	in/output	> 3m
	Signal/control (digital RVC)	input	> 3m
	Signal/control (analog RVC)	input	> 3m
	Signal/control (USB)	in/output	> 3m
	Signal/control (HDMI)	in/output	> 3m
	Antenna (FM/AM)	input	> 3m
	Antenna (GNSS)	input	> 3m
	Antenna (WIFI)	in/output	> 3m

*: as declared by applicant

6.5.4 Operation Modes during test	
Operation mode 1 (op.1)	Active RVC and continuous reception of a 400 Hz sine wave tone sent by a paired smartphone over FM radio.
Operation mode 2 (op.2)	Active RVC; continuous reception of a 400 Hz sine wave tone sent by a plugged media player over USB; unused ports terminated; WLAN, BT idle

7 Associated equipment (AE)

7.1 AE 1

Product description*

GPS antenna

Description*

Frequency: 1575.42 MHz

Voltage: 3 V – 5 V

Hardware status ---

Software status ---

7.2 AE 2

Product description*

WIFI antenna

Description*

Frequency: 2.4 – 5.85 GHz

Voltage: ---

Hardware status ---

Software status ---

7.3 AE 3

Product description*

DAB antenna (Delock12412)

Description*

Frequency: 174 MHz – 240 MHz

Gain: 5 dBi

Hardware status ---

Software status ---

7.4 AE 4

Product description*

Digital camera (RVC)

Description*

Model name:	---
Serial number:	C110001921601887
Hardware status	170100
Software status	182500 E179127 A

7.5 AE 5

Product description*

USB HUB

Description*

Model name:	---
Serial number:	---
Hardware status	---
Software status	---
Software status	---

7.6 AE 6

Product description*

CAN Tool 2

Description*

Model name:	CT2E1001-5HNL T
Serial number:	15G1368B
Hardware status	---
Software status	---

7.7 AE 7

Product description*

Termination jig

Description*

Model name:	---
Serial number:	---
Hardware status	---
Software status	---

7.8 AE 8

Product description*

Video conversion jig

Description*

Model name: JIG-FPDLink3-DVI-003

Serial number: 2394654-17

Hardware status ---

Software status ---

7.9 AE 9

Product description*

Display

Description*

Model name: ON-LAP 1303

Serial number: 11303253701429

Hardware status ---

Software status ---

8 TEST RESULTS

8.1 Conducted emission

Not performed. Vehicular equipment.

8.2 Radiated emission

8.2.1 Test plan

Test setup	EUT A + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT B + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT C + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT D + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT E + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9;
Operating mode	Operating mode 1 (op.1)
Limit	FCC: §15.109 Class B ICES: 3.2.2 Class B
Verdict	passed

Test setup	EUT A + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT B + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT C + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT D + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9; EUT E + AE 1 + AE 2 + AE 3 + AE 4 + AE 5 + AE 6 + AE 7 + AE 8 + AE 9;
Operating mode	Operating mode 2 (op.2)
Limit	FCC: §15.109 Class B ICES: 3.2.2 Class B
Verdict	passed

Comment:	Associated equipment depends on placement.
-----------------	--

8.2.2 Radiated emission limits (§15.109)

Description & Limits

§ 15.109 Radiated emission limits.

- (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	Field Strength [$\mu\text{V/m}$] / [dB $\mu\text{V/m}$]	Measurement distance [m]
30 – 88	100 / 40.0	3
88 – 216	150 / 43.5	3
216 – 960	200 / 46.0	3
960 – 40 000	500 / 54.0	3

- (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency [MHz]	Field Strength [$\mu\text{V/m}$] / [dB $\mu\text{V/m}$]	Measurement distance [m]
30 – 88	90 / 39.1	3
88 – 216	150 / 43.5	3
216 – 960	210 / 46.4	3
960 – 40 000	300 / 49.5	3

Note

Measurements with the peak detector are also suitable to demonstrate compliance of an EUT, as long as the required resolution bandwidth is used, because peak detection will yield amplitudes equal to or greater than amplitudes measured with RMS detector. The measurement data from a spectrum analyser peak detector will represent the worst-case results (see ANSI C63.10).

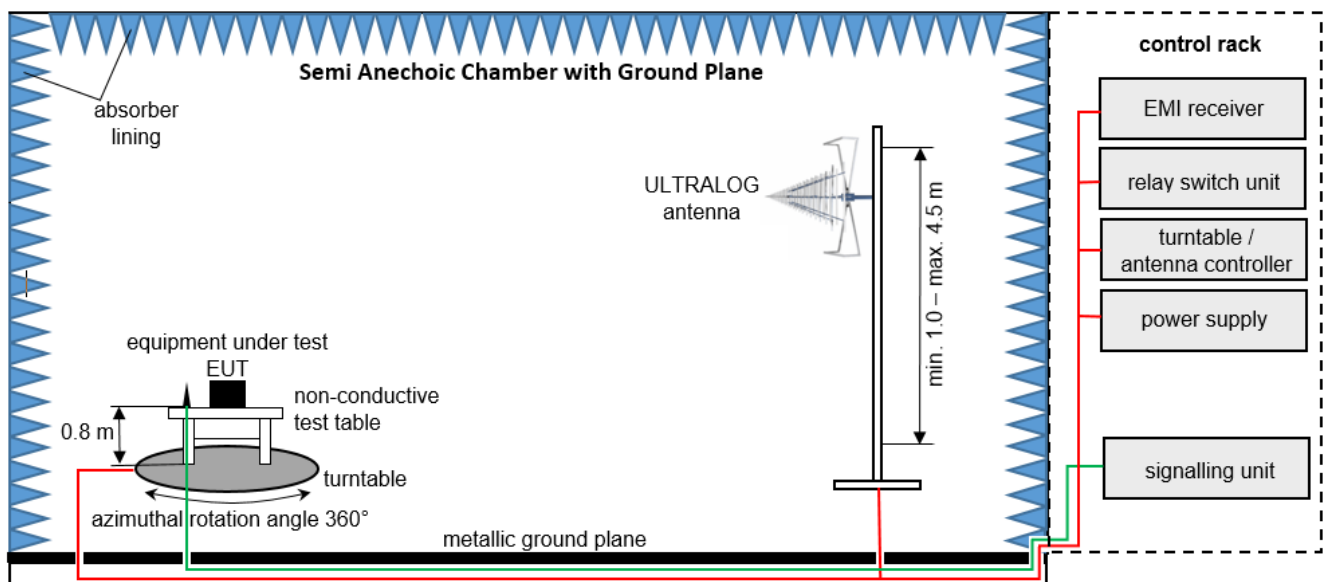
Typical test distances

Up to 18 GHz: 3.00 m
18 – 40 GHz: 0.50 m

8.2.3 Test Setup Description

8.2.3.1 Semi Anechoic Chamber with Ground Plane

Radiated measurements are performed in vertical and horizontal plane in the frequency range 30 MHz to 1 GHz in a Semi Anechoic Chamber with a metallic ground plane. The EUT is positioned on a non-conductive test table with a height of 0.80 m above the metallic ground plane that covers the whole chamber. The receiving antennas conform to specification ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.5 m in order to search for maximum field strength emitted from the EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by a spectrum analyzer where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: ULTRALOG antenna 3 meter
EMC32 software version: 11.10.00

FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

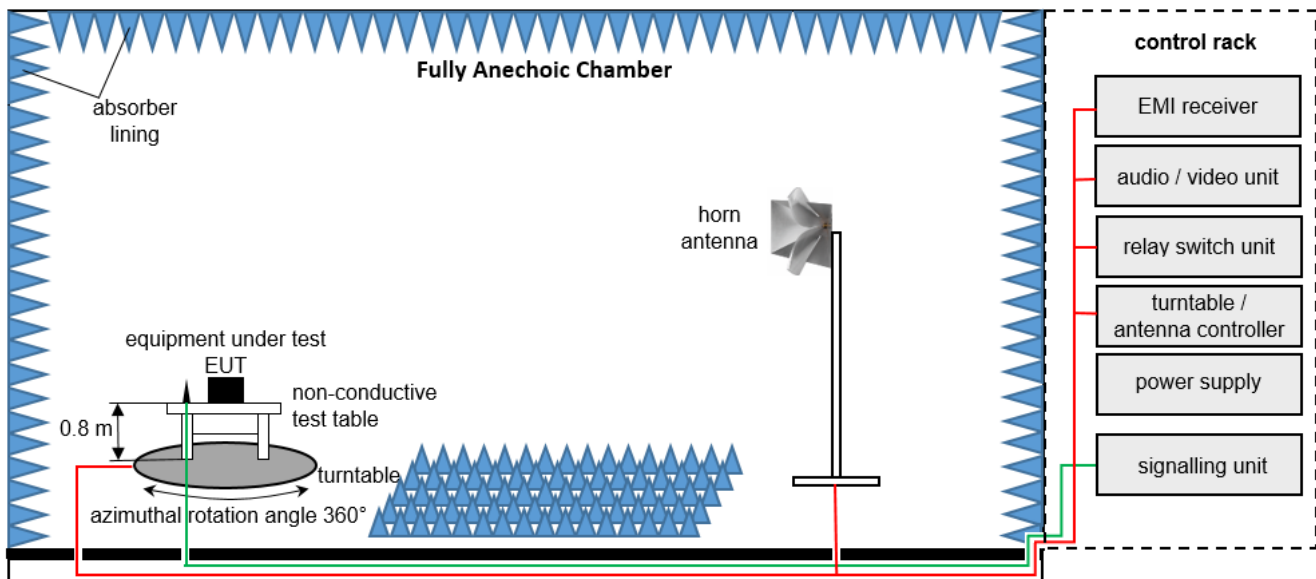
Example calculation:

FS [dBμV/m] = 12.35 [dBμV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBμV/m] (35.69 μV/m)

List of test equipment used:

#	Equipment	Type	Serial number	Internal number	Calibrated until	Used for test
1	EMI Test Receiver	Rohde & Schwarz ESW 26	101481	LAB000236	2022-07-01	☒
2	Open Switch and Control Platform	Rohde & Schwarz OSP-B200S2	101443	LAB000239	n/a	☒
3	Antenna	Rohde & Schwarz HL562E	102001	LAB000123	2023-07-05	☒

8.2.3.2 Fully Anechoic Chamber



Measurement distance: horn antenna 3 meter

EMC32 software version: 11.10.00

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

List of test equipment used:

#	Equipment	Type	Serial number	Internal number	Calibrated until	Used for test
1	EMI Test Receiver	Rohde & Schwarz ESW 26	101481	LAB000236	2022-07-01	☒
2	Open Switch and Control Platform	Rohde & Schwarz OSP-B200S2	101443	LAB000239	n/a	☒
3	Antenna	Rohde & Schwarz HF907	102899	LAB000151	2023-04-23	☒
4	Pre-Amplifier	Schwarzbeck BBV 9718 C	84	LAB000169	n/a	☒

8.2.4 Test Setup Description

8.2.4.1 Radiated spurious emissions from 30 MHz to 1 GHz

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- In case of floor standing equipment, it is placed in the middle of the turn table.
In case of tabletop equipment it is placed on a non-conductive table with a height of 80 cm.
- Additional equipment, cables, ... necessary for testing, are positioned like under normal operation.
- Interface cables, e.g. power supply, network, ... are connected to the connection box in the turn table.
- EUT is powered on and set into operation.

Pre-scan

- Turntable performs an azimuthal rotation from 0° to 315° in 45° steps.
- Antenna polarisation is changed (H-V / V-H) and antenna height is changed from 1 meter to 4 meters.
- For each turntable step / antenna polarisation / antenna height the EMI-receiver/spectrum analyser performs a positive-peak/max-hold sweep (=worst-case). Data is transferred to EMI-software and recorded. EMI-software will show the maximum level of all single sweeps as the final result for the pre-scan.

Final measurement

- Significant emissions found during the pre-scan will be maximized by the EMI-software based on evaluated data during the pre-scan by rotating the turntable and changing antenna height and polarisation.
- Final measurement will be performed with measuring equipment settings as defined in the applicable test standards (e.g. ANSI C63.4).
- Plot of the pre-scan with frequencies of identified emissions including levels, correction factors, turn table position, antenna polarisation and settings of measuring equipment is recorded.

Detailed requirements can be found in e.g. ANSI C63.4

8.2.4.2 *Radiated spurious emissions from 1 GHz to 18 GHz*

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- In case of floor standing equipment, it is placed in the middle of the turn table.
In case of tabletop equipment it is placed on a non-conductive table with a height of 80 cm.
- Additional equipment, cables, ... necessary for testing, are positioned like under normal operation.
- Interface cables, e.g. power supply, network, ... are connected to the connection box in the turn table.
- EUT is powered on and set into operation.

Pre-scan

- Turntable performs an azimuthal rotation from 0° to 315° in 45° steps.
- Antenna polarisation is changed (H-V / V-H) and antenna height is changed from 1 meter to 4 meters.
- For each turntable step / antenna polarisation / antenna height the EMI-receiver/spectrum analyser performs a positive-peak/max-hold sweep (=worst-case). Data is transferred to EMI-software and recorded. EMI-software will show the maximum level of all single sweeps as the final result for the pre-scan.

Final measurement

- Significant emissions found during the pre-scan will be maximized by the EMI-software based on evaluated data during the pre-scan by rotating the turntable and changing antenna height and polarisation.
- Final measurement will be performed with measuring equipment settings as defined in the applicable test standards (e.g. ANSI C63.4).
- Plot of the pre-scan with frequencies of identified emissions including levels, correction factors, turn table position, antenna polarisation and settings of measuring equipment is recorded.

Detailed requirements can be found in e.g. ANSI C63.4

8.2.4.3 Radiated spurious emissions above 18 GHz

Test setup

- The EUT is set up according to its intended use, as described in the user manual or as defined by the manufacturer.
- Additional equipment, cables, ... necessary for testing, are positioned like under normal operation.
- EUT is powered on and set into operation.
- Test distance depends on EUT size and test antenna size (farfield conditions shall be met).

Pre-scan

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and for different polarizations of the antenna.

Final measurement

- Significant emissions found during the pre-scan will be maximized, i.e. position and antenna orientation causing the highest emissions with Peak and RMS detector
- Final measurement will be performed with measuring equipment settings as defined in the applicable test standards (e.g. ANSI C63.4).
- Final plot showing measurement data, levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit is recorded.

Note

- In case of measurements with external harmonic mixers (e.g. above 50 GHz) special care is taken to avoid possible overloading of the external mixer's input.
- As external harmonic mixers may generate false images, care is taken to ensure that any emission measured by the spectrum analyzer is indeed radiated from the EUT and not internally generated by the external harmonic mixer. Signal identification feature of spectrum analyzer is used to eliminate/reduce images of the external harmonic mixer.

Detailed requirements can be found in e.g. ANSI C63.4

8.2.5 Measurement results

Refer to *Annex A*
 Annex B
 Annex C
 Annex D
 Annex E

9 MEASUREMENT UNCERTAINTY

#	Test	Measurement uncertainty	
1	Conducted emissions CISPR 16-4-2	2.21 dB	
2	Radiated emissions CISPR 16-4-2	30 ... 1000 MHz 1 ... 18 GHz	3.68dB 3.64 dB
3	Harmonics / Flicker EN / IEC 61000-4-15	Current AC 350uA-320mA / 50Hz-5kHz Current AC 350mA-2.2A / 50Hz-5kHz Current AC 2.5A-10A / 50Hz-1kHz Current AC 2A-80A / 50Hz-1kHz Resistor DC Inductance Short-term flicker severity Maximum steady state voltage Maximum absolute voltage change Maximum time duration during observation Voltage AC 1V-1000V / 16Hz-10kHz	0.24 % 0.40 % 0.27 % 0.20 % 0.23 % 0.23 % 0.24 % 0.24 % 0.24 % 0.24 % 0.20 %
4	Radio frequency electromagnetic field EN / IEC 61000-4-3	1.98 dB	
5	Electrical fast transients / Burst EN / IEC 61000-4-4	Peak Voltage Rise time Duration Frequency oscilloscope	6.05 % 186 ps 1602 ps 0.014 %
6	Surges EN / IEC 61000-4-5	Peak current Front & Rise time Duration Frequency oscilloscope Peak voltage Front & Rise time Duration	3.67 % 76000 ps 76000 ps 0.014 % 4.87 % 4600 ps 4600 ps
7	Conducted disturbances EN / IEC 61000-4-6	3.47 dB	
8	Voltage dips and interruptions EN / IEC 61000-4-11	Voltage AC 1mV-1000V Current AC Inrush Current Rise / Fall time Duration	4.95 % 3.82 % 3.71 % 18.4 ns 46000 ps

END OF TEST REPORT

Annex A

Measurement results of EUT A

part of / in addition to

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

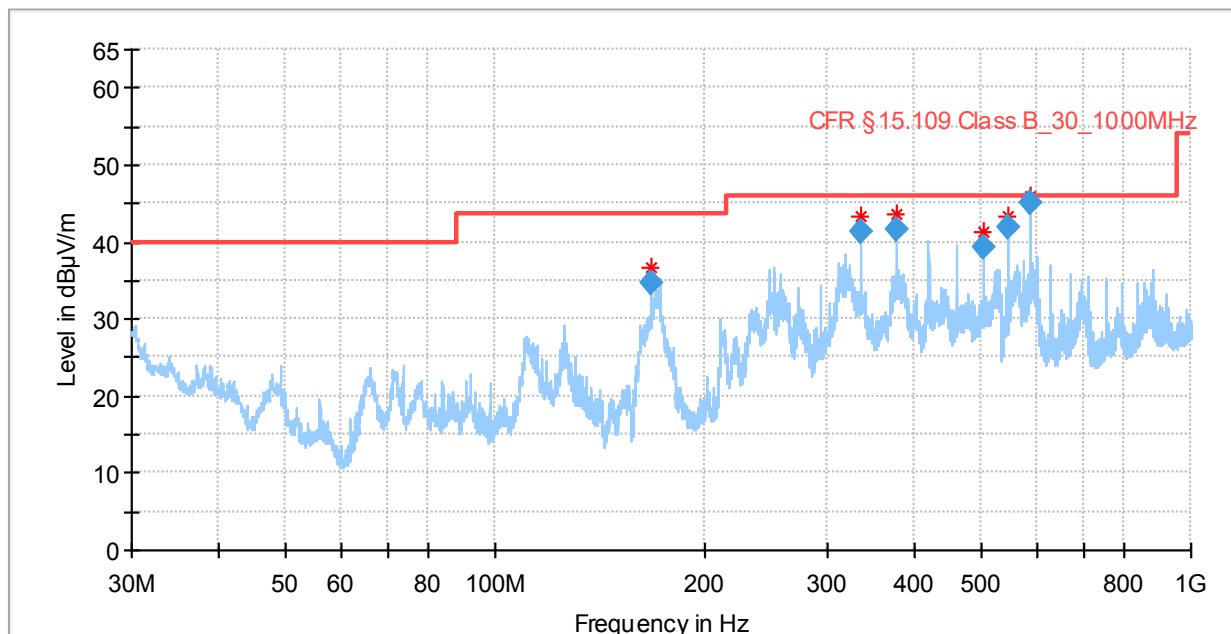
1 Emission tests

1.1 Electromagnetic radiated emission (30 ... 1000 MHz)

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #28
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+ * Critical_Freqs PK+
 — CFR § 15.109 Class B_30_1000MHz ◆ Final_Result QPK

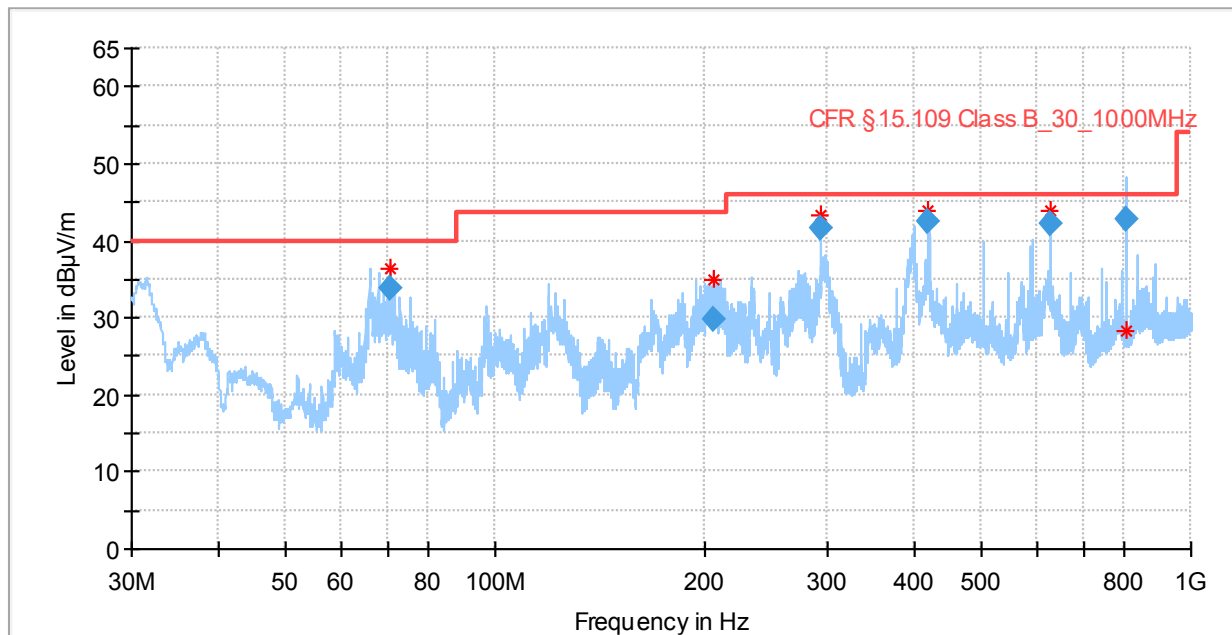
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
168.000000	34.65	43.50	8.85	15000.0	120.000	100.0	V	-12.0	10.7
336.000000	41.26	46.00	4.74	15000.0	120.000	100.0	H	-34.0	14.8
378.000000	41.70	46.00	4.30	15000.0	120.000	104.0	H	264.0	15.9
504.000000	39.21	46.00	6.79	15000.0	120.000	100.0	H	117.0	18.9
546.000000	41.91	46.00	4.09	15000.0	120.000	103.0	H	8.0	19.3
588.000000	45.17	46.00	0.83	15000.0	120.000	100.0	H	257.0	20.2

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #28
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 2
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

Final Result

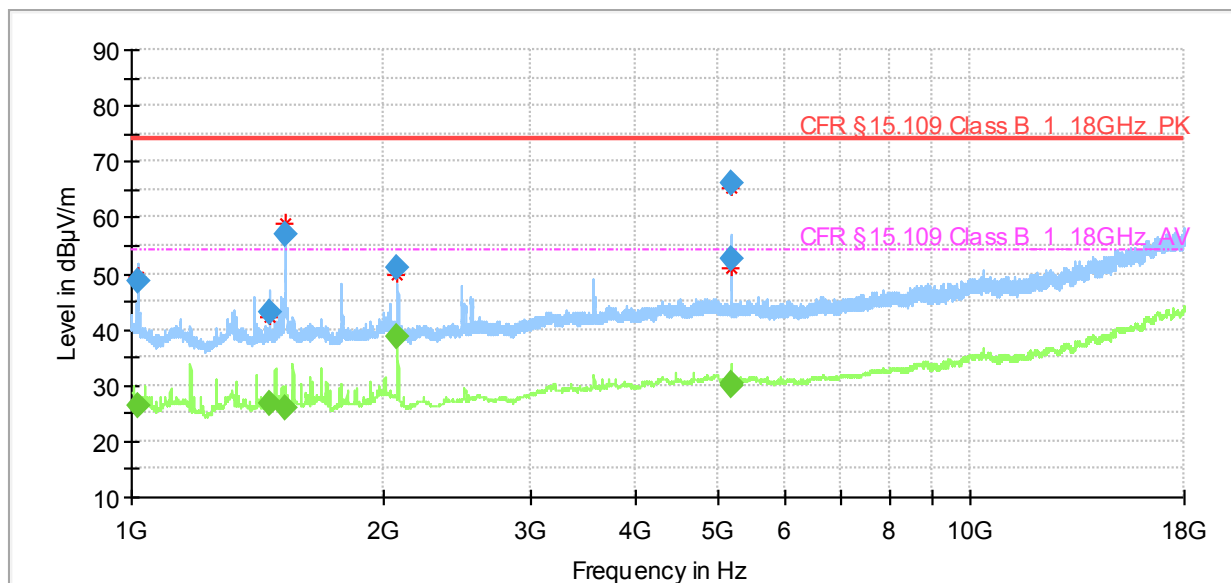
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
70.440000	33.73	40.00	6.27	15000.0	120.000	118.0	V	114.0	10.0
206.310000	29.73	43.50	13.77	15000.0	120.000	118.0	V	97.0	11.5
294.000000	41.52	46.00	4.48	15000.0	120.000	100.0	H	256.0	13.7
420.000000	42.54	46.00	3.46	15000.0	120.000	100.0	H	239.0	17.0
630.000000	42.17	46.00	3.83	15000.0	120.000	100.0	H	44.0	20.6
810.060000	42.66	46.00	3.34	15000.0	120.000	120.0	V	251.0	23.1

1.2 Electromagnetic radiated emission (1 ... 18 GHz)

EUT Information

EUT Name: R1LOW-R-SBM
ID: #28
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 1
Operator: Schmidt
Comment: DC 13.5 V

Full Spectrum



— Preview Result 2-AVG
* Critical_Freqs AVG
— CFR §15.109 Class B_1_18GHz_PK
◆ Final_Result PK+
— Preview Result 1-PK+
* Critical_Freqs PK+
— CFR §15.109 Class B_1_18GHz_AV
◆ Final_Result AVG

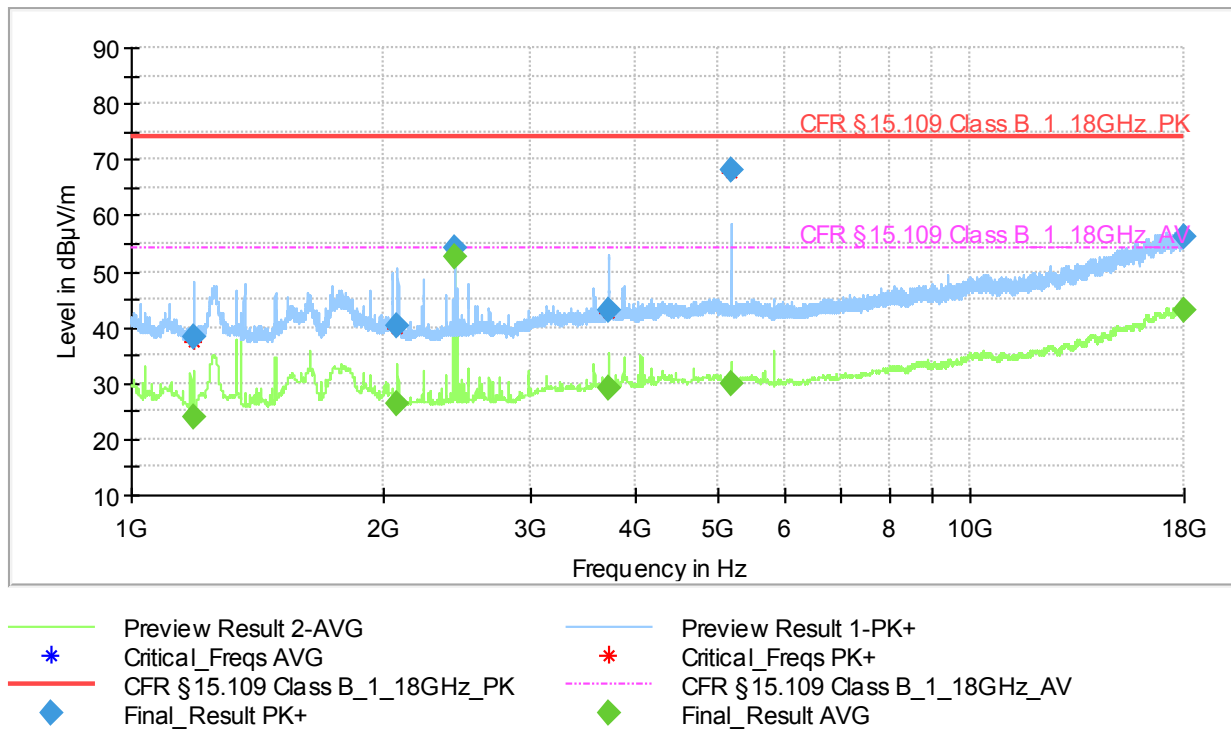
Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1017.500000	---	26.35	54.00	27.65	15000.0	1000.000	V	106.0	-3.0
1017.500000	48.63	---	74.00	25.37	15000.0	1000.000	V	106.0	-3.0
1462.750000	---	26.84	54.00	27.16	15000.0	1000.000	H	113.0	-1.1
1462.750000	43.11	---	74.00	30.89	15000.0	1000.000	H	113.0	-1.1
1526.250000	57.05	---	74.00	16.95	15000.0	1000.000	H	327.0	-0.5
1526.250000	---	25.84	54.00	28.16	15000.0	1000.000	H	327.0	-0.5
2078.000000	51.01	---	74.00	22.99	15000.0	1000.000	V	29.0	2.4
2078.000000	---	38.60	54.00	15.40	15000.0	1000.000	V	29.0	2.4
5180.250000	66.13	---	74.00	7.87	15000.0	1000.000	H	237.0	10.5
5180.250000	---	30.10	54.00	23.90	15000.0	1000.000	H	237.0	10.5
5192.250000	52.77	---	74.00	21.23	15000.0	1000.000	H	232.0	10.5
5192.250000	---	30.10	54.00	23.90	15000.0	1000.000	H	232.0	10.5

EUT Information

EUT Name: R1LOW-R-SBM
ID: #28
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 2
Operator: Schmidt
Comment: DC 13.5 V

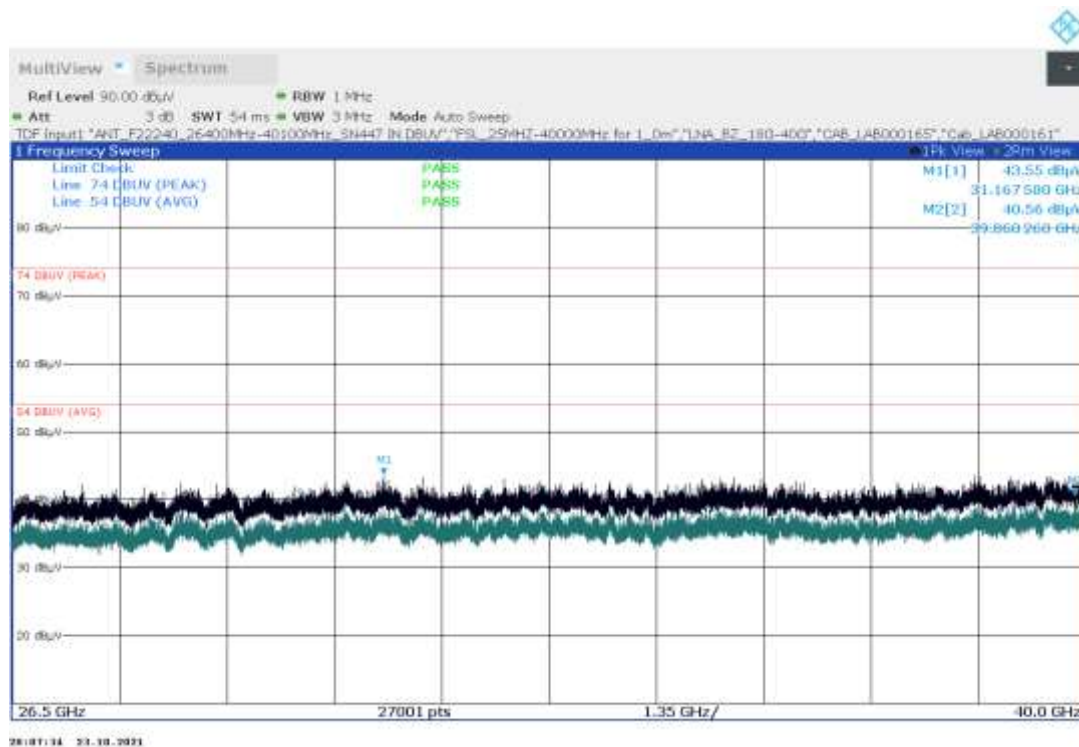
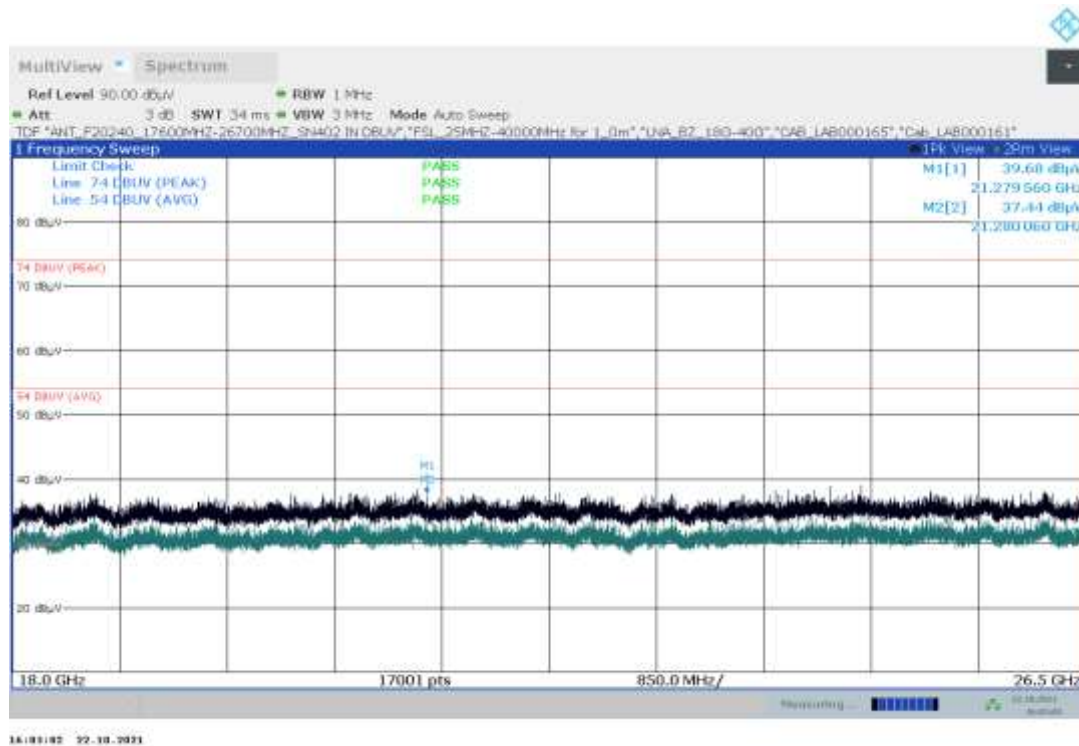
Full Spectrum

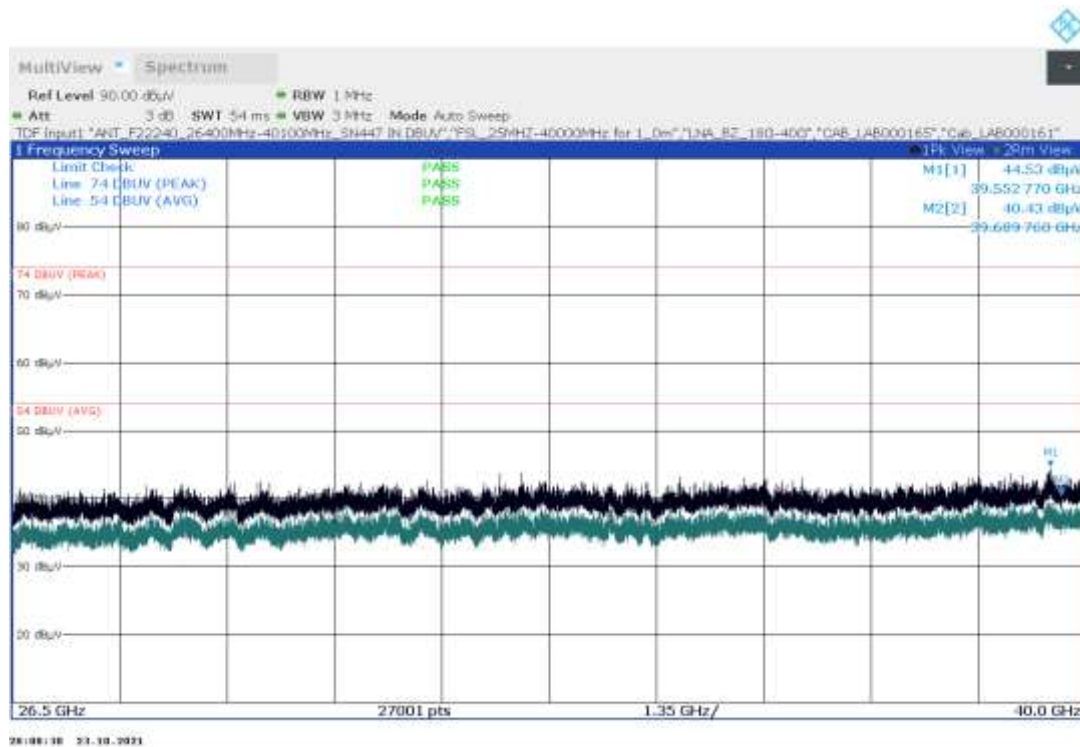
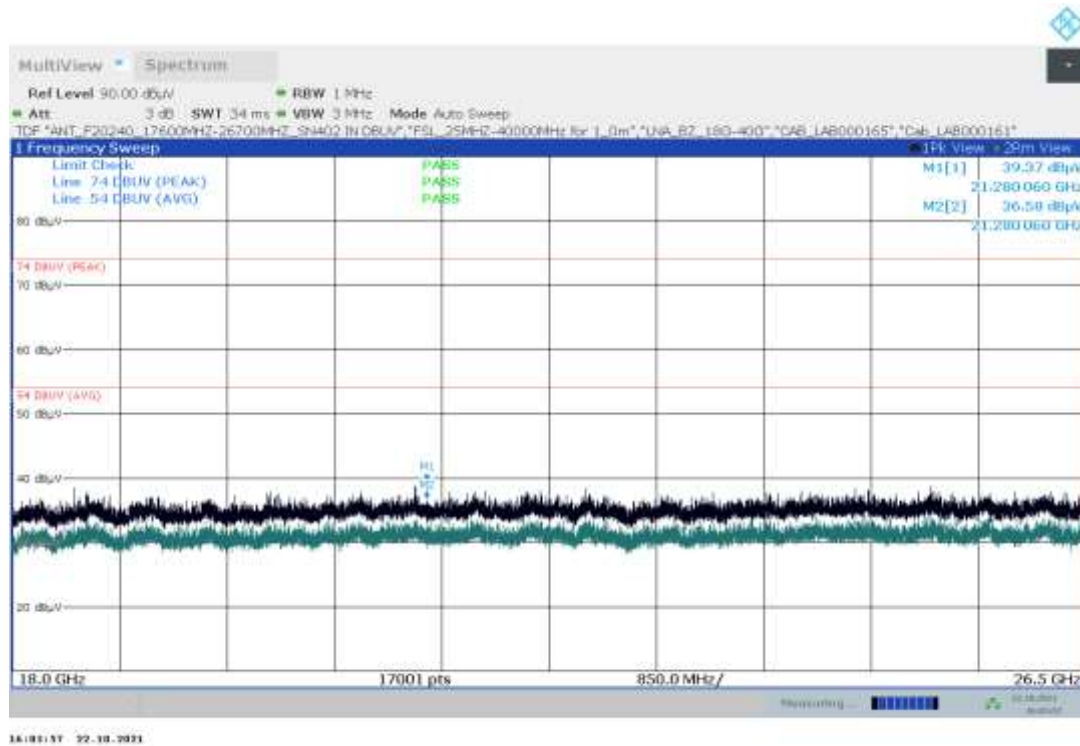


Final_Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1187.500000	38.32	---	74.00	35.68	15000.0	1000.000	V	264.0	-2.8
1187.500000	---	23.98	54.00	30.02	15000.0	1000.000	V	264.0	-2.8
2078.500000	40.07	---	74.00	33.93	15000.0	1000.000	V	293.0	2.4
2078.500000	---	26.14	54.00	27.86	15000.0	1000.000	V	293.0	2.4
2430.000000	---	52.39	54.00	1.61	15000.0	1000.000	V	291.0	3.2
2430.000000	54.16	---	74.00	19.84	15000.0	1000.000	V	291.0	3.2
3711.000000	43.10	---	74.00	30.90	15000.0	1000.000	V	309.0	8.1
3711.000000	---	29.18	54.00	24.82	15000.0	1000.000	V	309.0	8.1
5179.750000	68.04	---	74.00	5.96	15000.0	1000.000	H	66.0	10.5
5179.750000	---	29.93	54.00	24.07	15000.0	1000.000	H	66.0	10.5
17996.000000	---	42.84	54.00	11.16	15000.0	1000.000	H	53.0	27.6
17996.000000	56.30	---	74.00	17.70	15000.0	1000.000	H	53.0	27.6

1.3 Electromagnetic radiated emission (18 ... 40 GHz)





END OF ANNEX A

Annex B

Measurement results of EUT B

part of / in addition to

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

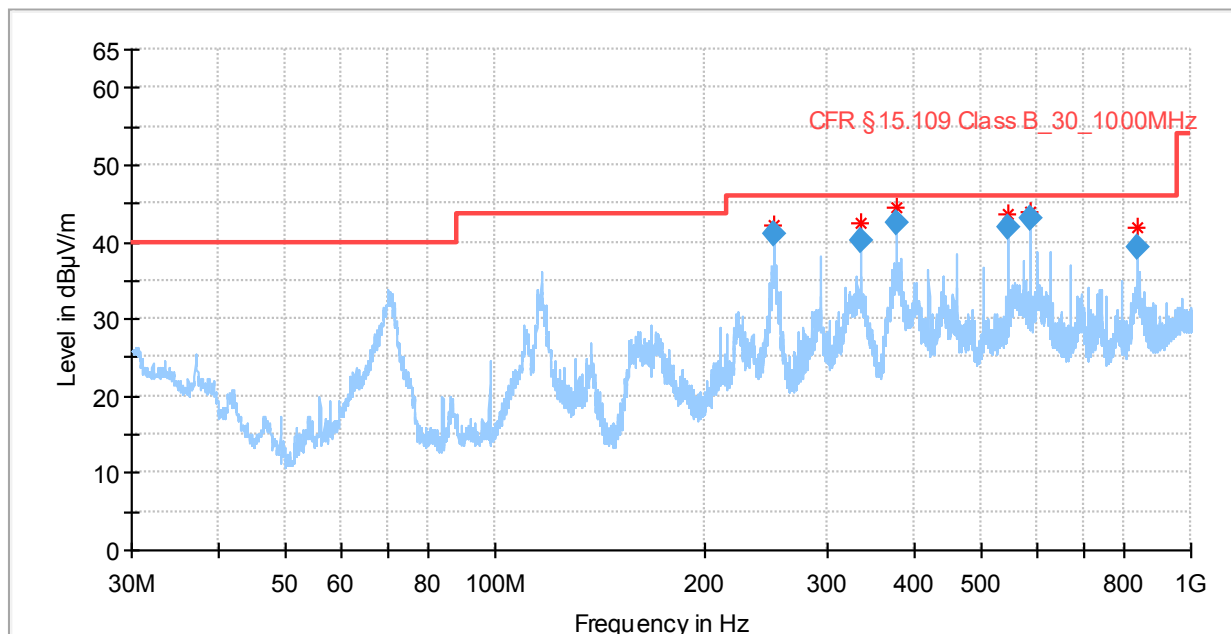
1 Emission tests

1.1 Electromagnetic radiated emission (30 ... 1000 MHz)

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #33
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

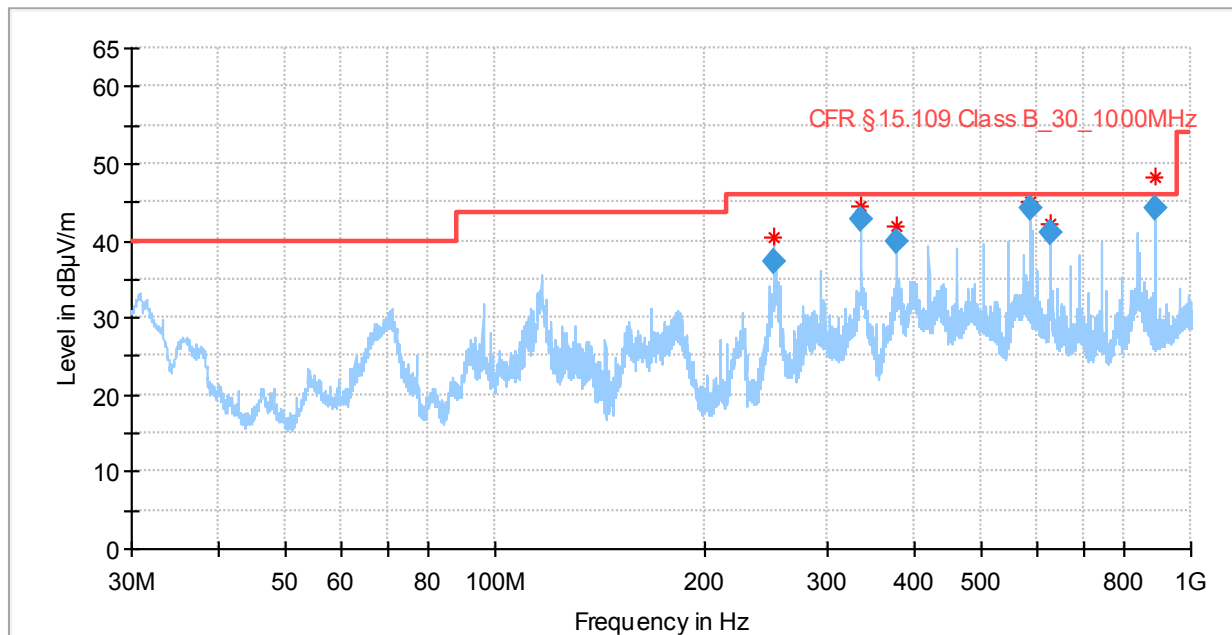
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
252.000000	40.89	46.00	5.11	15000.0	120.000	130.0	H	144.0	12.5
336.000000	40.25	46.00	5.75	15000.0	120.000	100.0	V	34.0	14.8
378.000000	42.60	46.00	3.40	15000.0	120.000	104.0	V	44.0	15.9
546.000000	42.03	46.00	3.97	15000.0	120.000	104.0	H	6.0	19.3
588.000000	43.12	46.00	2.88	15000.0	120.000	130.0	V	103.0	20.2
840.000000	39.28	46.00	6.72	15000.0	120.000	104.0	V	190.0	23.4

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #33
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 2
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

Final Result

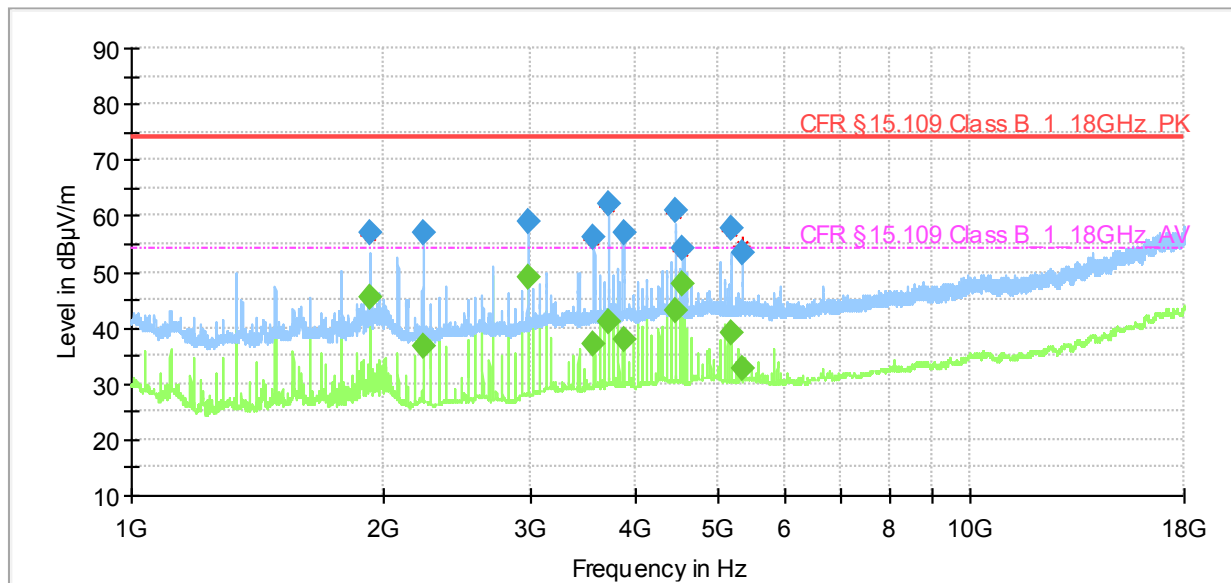
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
252.030000	37.27	46.00	8.73	15000.0	120.000	130.0	H	105.0	12.5
336.000000	42.63	46.00	3.37	15000.0	120.000	104.0	V	23.0	14.8
378.000000	39.99	46.00	6.01	15000.0	120.000	100.0	V	93.0	15.9
588.000000	44.23	46.00	1.77	15000.0	120.000	120.0	V	86.0	20.2
630.000000	41.16	46.00	4.84	15000.0	120.000	100.0	H	168.0	20.6
890.610000	44.21	46.00	1.79	15000.0	120.000	103.0	V	121.0	24.0

1.2 Electromagnetic radiated emission (1 ... 18 GHz)

EUT Information

EUT Name: R1LOW-R-SBM
ID: #33
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 1
Operator: Schmidt
Comment: DC 13.5 V

Full Spectrum



— Preview Result 2-AVG
* Critical_Freqs AVG
— CFR §15.109 Class B_1_18GHz_PK
◆ Final_Result PK+

— Preview Result 1-PK+
* Critical_Freqs PK+
— CFR §15.109 Class B_1_18GHz_AV
◆ Final_Result AVG

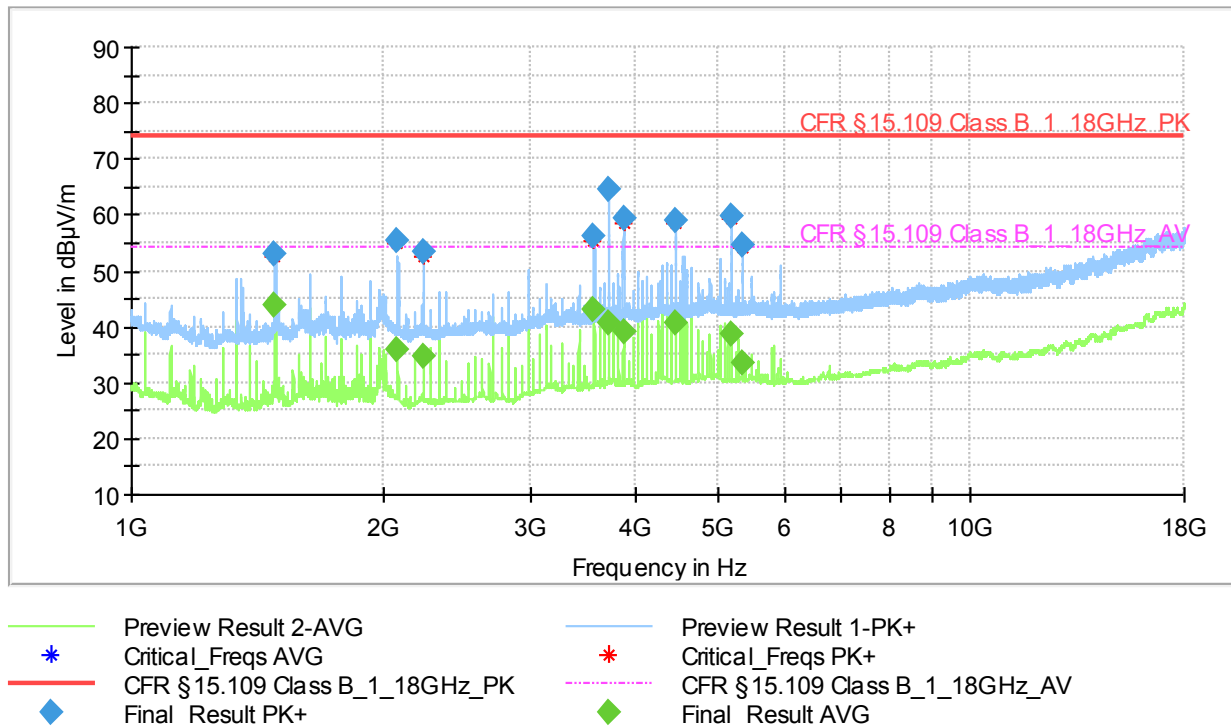
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1929.500000	---	45.55	54.00	8.45	15000.0	1000.000	V	206.0	1.5
1929.500000	56.80	---	74.00	17.20	15000.0	1000.000	V	206.0	1.5
2226.500000	---	36.68	54.00	17.32	15000.0	1000.000	H	148.0	2.3
2226.500000	56.85	---	74.00	17.15	15000.0	1000.000	H	148.0	2.3
2969.000000	59.15	---	74.00	14.85	15000.0	1000.000	H	221.0	5.2
2969.000000	---	48.99	54.00	5.01	15000.0	1000.000	H	221.0	5.2
3562.750000	56.05	---	74.00	17.95	15000.0	1000.000	H	188.0	7.3
3562.750000	---	37.04	54.00	16.96	15000.0	1000.000	H	188.0	7.3
3710.750000	62.31	---	74.00	11.69	15000.0	1000.000	H	192.0	8.1
3710.750000	---	41.09	54.00	12.91	15000.0	1000.000	H	192.0	8.1
3859.500000	57.03	---	74.00	16.97	15000.0	1000.000	H	186.0	8.6
3859.500000	---	37.67	54.00	16.33	15000.0	1000.000	H	186.0	8.6
4453.500000	60.94	---	74.00	13.06	15000.0	1000.000	H	214.0	9.6
4453.500000	---	42.90	54.00	11.10	15000.0	1000.000	H	214.0	9.6
4552.000000	---	47.73	54.00	6.27	15000.0	1000.000	H	179.0	9.6
4552.000000	54.20	---	74.00	19.80	15000.0	1000.000	H	179.0	9.6
5195.250000	---	38.91	54.00	15.09	15000.0	1000.000	H	208.0	10.5
5195.250000	57.85	---	74.00	16.15	15000.0	1000.000	H	208.0	10.5
5343.500000	53.42	---	74.00	20.58	15000.0	1000.000	H	181.0	10.8
5343.500000	---	32.75	54.00	21.25	15000.0	1000.000	H	181.0	10.8

EUT Information

EUT Name: R1LOW-R-SBM
ID: #33
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 2
Operator: Schmidt
Comment: DC 13.5 V

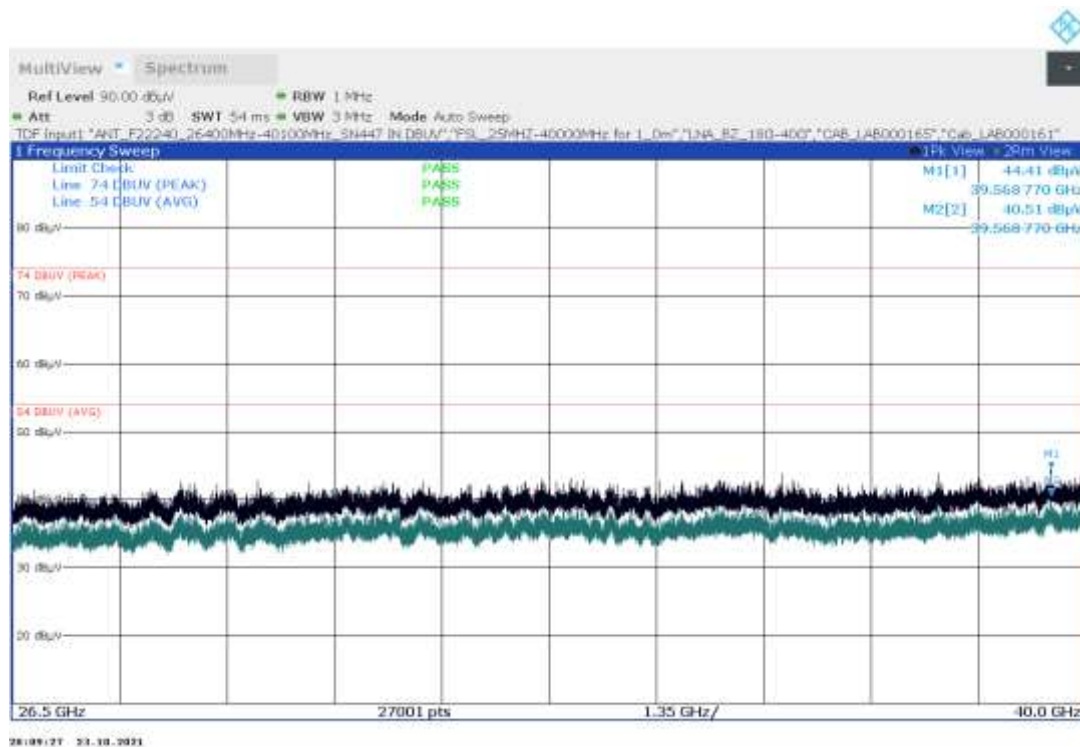
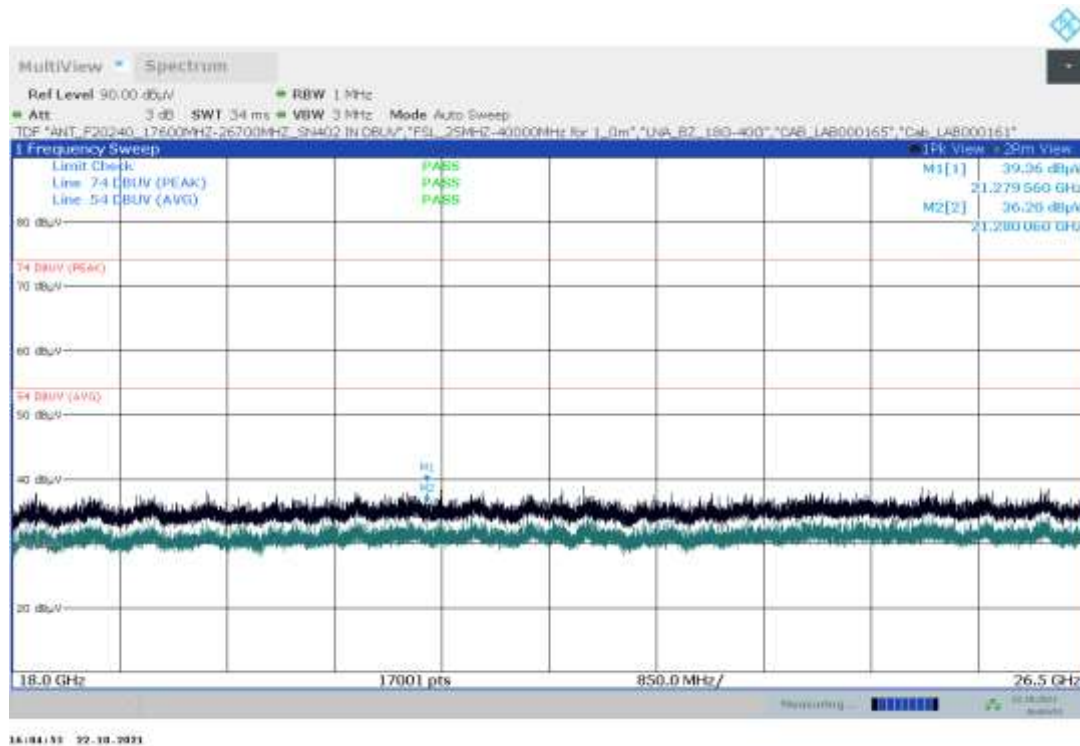
Full Spectrum

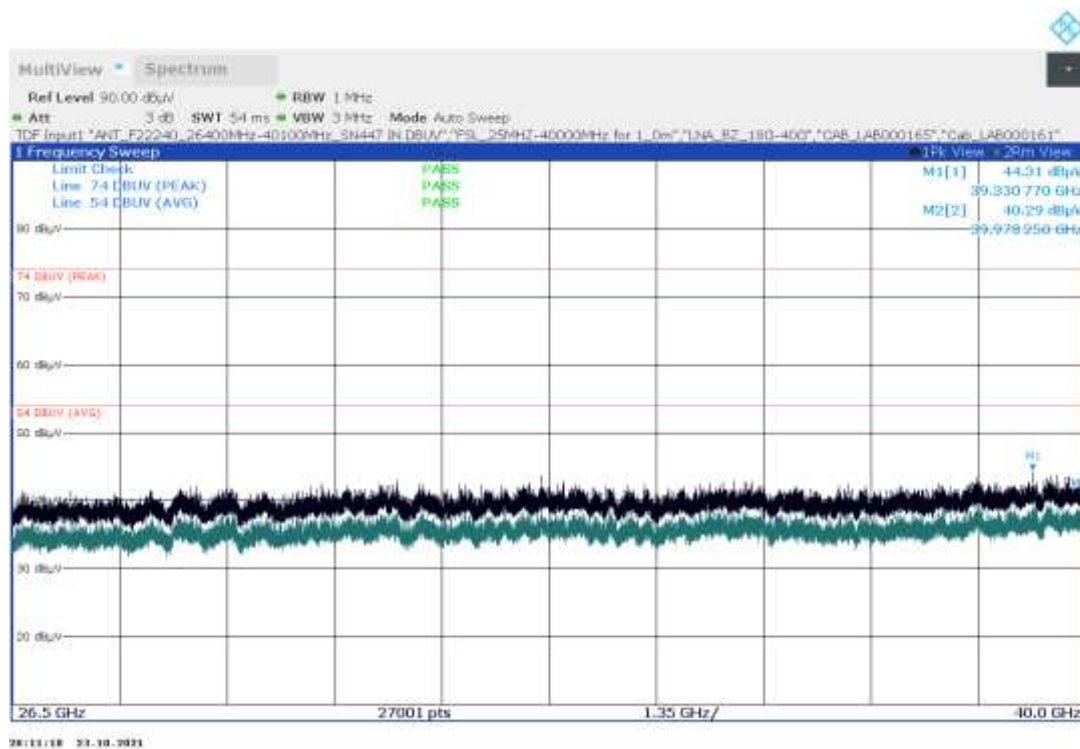
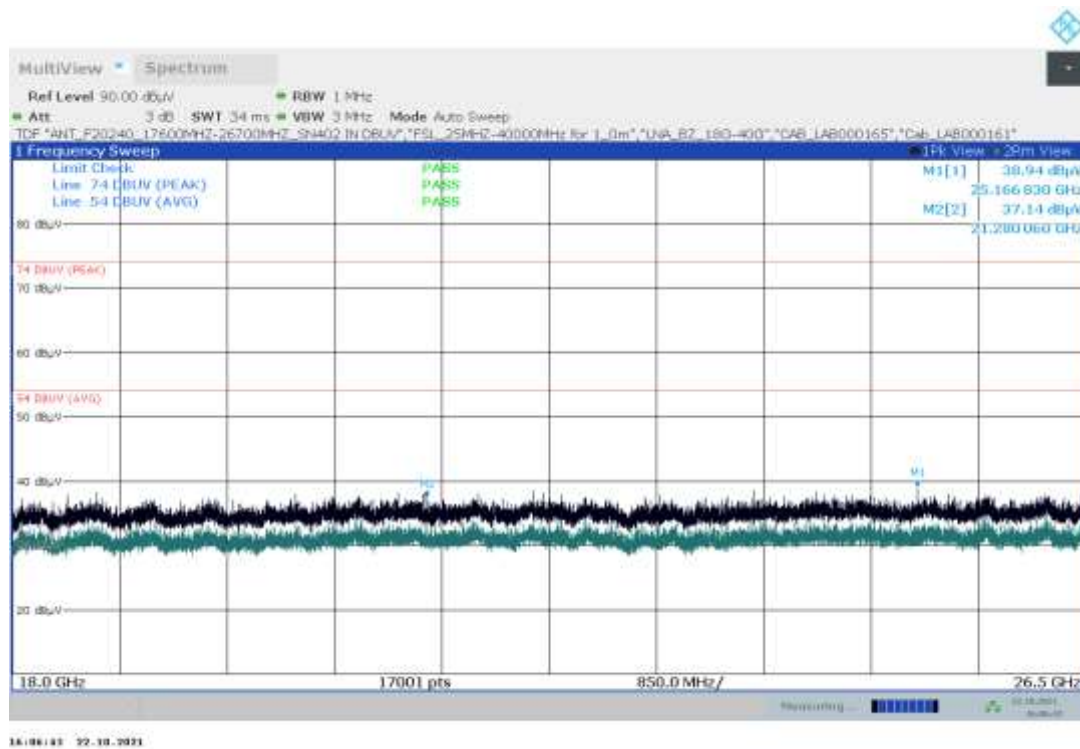


Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1484.250000	---	43.88	54.00	10.12	15000.0	1000.000	V	178.0	-0.9
1484.250000	53.03	---	74.00	20.97	15000.0	1000.000	V	178.0	-0.9
2077.750000	---	36.06	54.00	17.94	15000.0	1000.000	V	175.0	2.4
2077.750000	55.30	---	74.00	18.70	15000.0	1000.000	V	175.0	2.4
2226.750000	53.56	---	74.00	20.44	15000.0	1000.000	H	159.0	2.3
2226.750000	---	34.59	54.00	19.41	15000.0	1000.000	H	159.0	2.3
3562.750000	---	43.00	54.00	11.00	15000.0	1000.000	V	178.0	7.3
3562.750000	55.99	---	74.00	18.01	15000.0	1000.000	V	178.0	7.3
3710.750000	---	40.79	54.00	13.21	15000.0	1000.000	H	220.0	8.1
3710.750000	64.59	---	74.00	9.41	15000.0	1000.000	H	220.0	8.1
3859.500000	---	38.89	54.00	15.11	15000.0	1000.000	H	215.0	8.6
3859.500000	59.21	---	74.00	14.79	15000.0	1000.000	H	215.0	8.6
4453.500000	---	40.75	54.00	13.25	15000.0	1000.000	H	177.0	9.6
4453.500000	59.05	---	74.00	14.95	15000.0	1000.000	H	177.0	9.6
5195.750000	59.87	---	74.00	14.13	15000.0	1000.000	V	215.0	10.5
5195.750000	---	38.55	54.00	15.45	15000.0	1000.000	V	215.0	10.5
5344.000000	---	33.45	54.00	20.55	15000.0	1000.000	H	179.0	10.8
5344.000000	54.69	---	74.00	19.31	15000.0	1000.000	H	179.0	10.8

1.3 Electromagnetic radiated emission (18 ... 40 GHz)





END OF ANNEX B

Annex C

Measurement results of EUT C

part of / in addition to

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

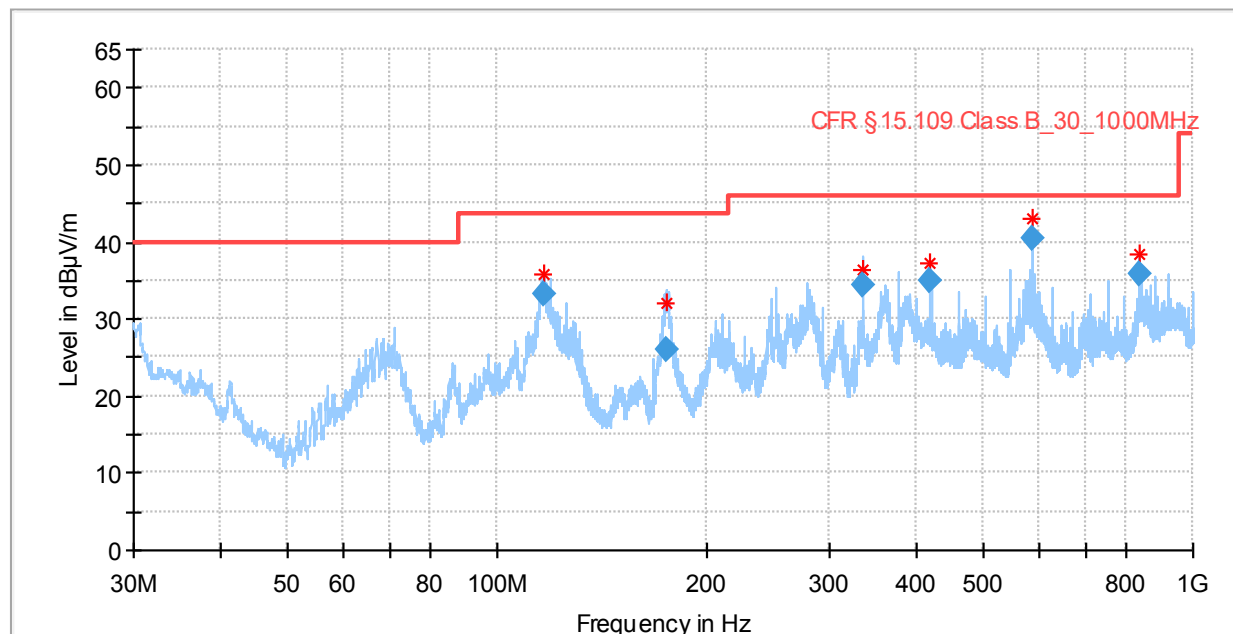
1 Emission tests

1.1 Electromagnetic radiated emission (30 ... 1000 MHz)

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #39
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

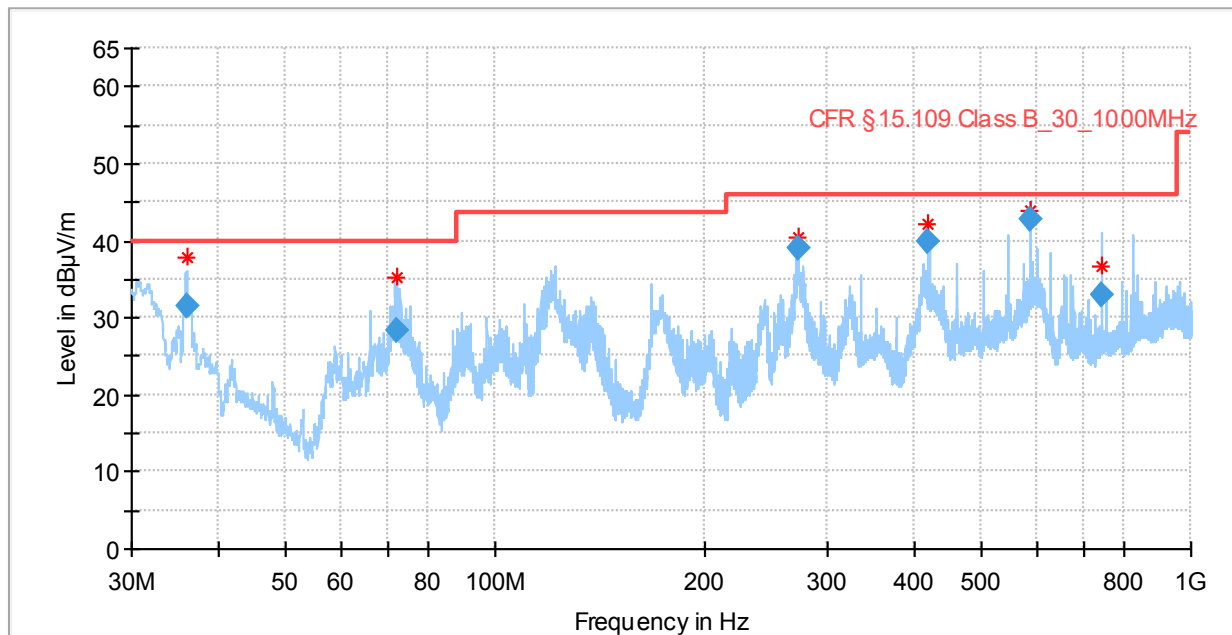
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
116.940000	33.34	43.50	10.16	15000.0	120.000	118.0	V	-18.0	13.0
175.200000	26.08	43.50	17.42	15000.0	120.000	100.0	V	4.0	11.3
336.000000	34.32	46.00	11.68	15000.0	120.000	112.0	H	192.0	14.8
420.000000	34.93	46.00	11.07	15000.0	120.000	104.0	V	-10.0	17.0
588.000000	40.51	46.00	5.49	15000.0	120.000	105.0	V	33.0	20.2
840.000000	35.70	46.00	10.30	15000.0	120.000	100.0	H	48.0	23.4

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #39
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

Final Result

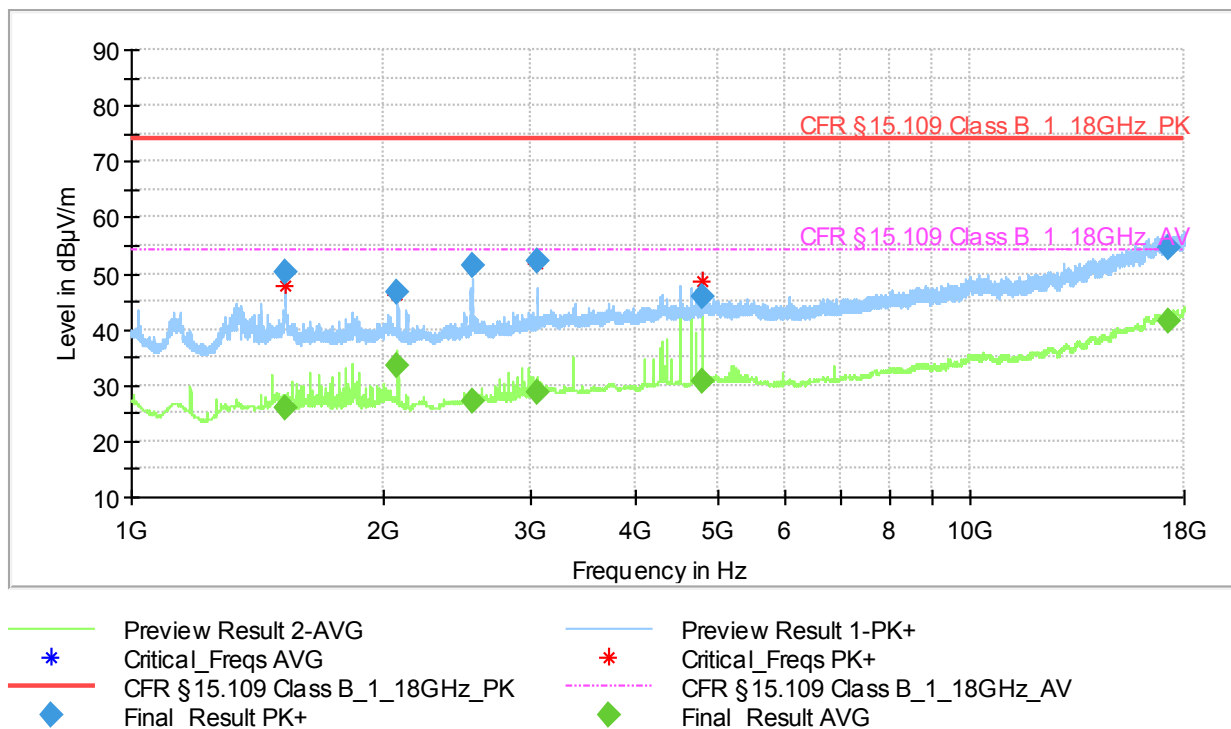
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.970000	31.55	40.00	8.45	15000.0	120.000	103.0	V	270.0	17.4
71.970000	28.34	40.00	11.66	15000.0	120.000	113.0	V	14.0	10.3
272.040000	39.01	46.00	6.99	15000.0	120.000	100.0	V	215.0	13.0
420.000000	39.80	46.00	6.20	15000.0	120.000	103.0	H	-21.0	17.0
588.000000	42.68	46.00	3.32	15000.0	120.000	103.0	V	90.0	20.2
742.200000	33.08	46.00	12.92	15000.0	120.000	100.0	V	287.0	22.2

1.2 Electromagnetic radiated emission (1 ... 18 GHz)

EUT Information

EUT Name: R1LOW-R-SBM
ID: #39
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 1
Operator: Schmidt
Comment: DC 13.5 V

Full Spectrum



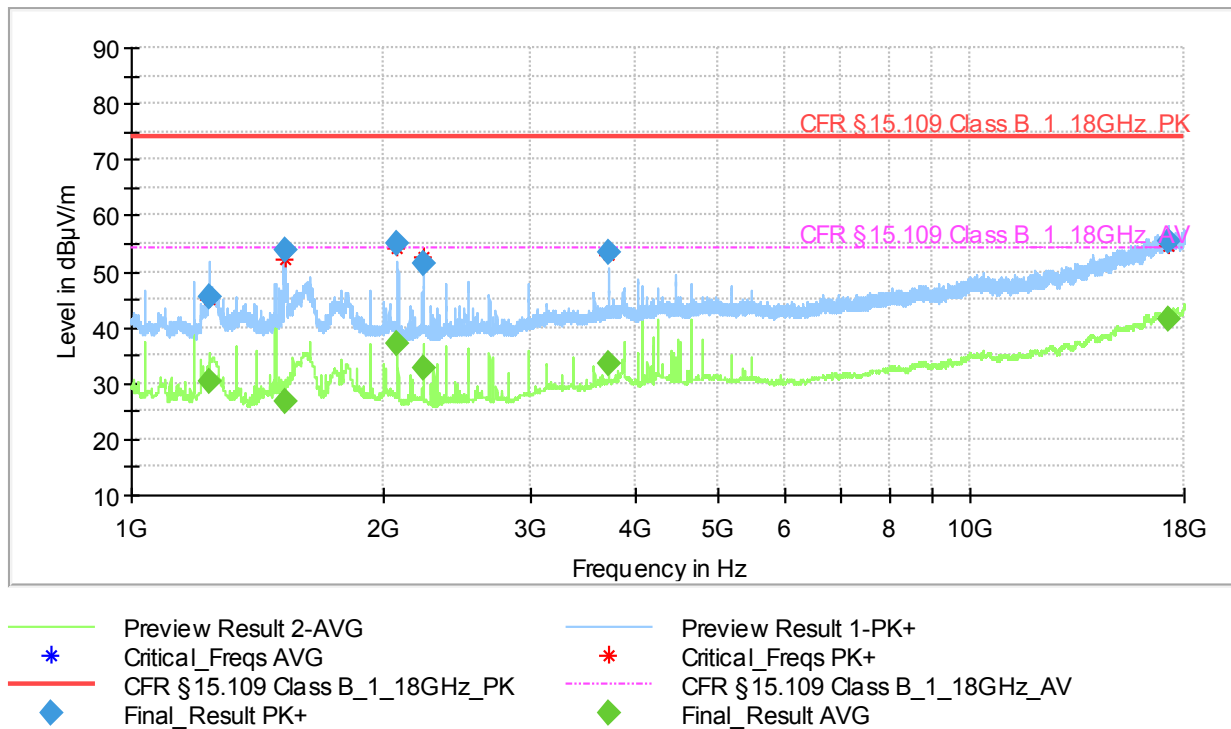
Final_Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1525.500000	---	25.75	54.00	28.25	15000.0	1000.000	H	38.0	-0.5
1525.500000	50.35	---	74.00	23.65	15000.0	1000.000	H	38.0	-0.5
2078.250000	---	33.54	54.00	20.46	15000.0	1000.000	H	72.0	2.4
2078.250000	46.63	---	74.00	27.37	15000.0	1000.000	H	72.0	2.4
2545.250000	51.55	---	74.00	22.45	15000.0	1000.000	V	47.0	3.9
2545.250000	---	27.19	54.00	26.81	15000.0	1000.000	V	47.0	3.9
3053.250000	---	28.67	54.00	25.33	15000.0	1000.000	H	175.0	6.1
3053.250000	52.24	---	74.00	21.76	15000.0	1000.000	H	175.0	6.1
4784.500000	---	30.80	54.00	23.20	15000.0	1000.000	V	3.0	10.3
4784.500000	45.99	---	74.00	28.01	15000.0	1000.000	V	3.0	10.3
17206.750000	54.65	---	74.00	19.35	15000.0	1000.000	H	327.0	25.5
17206.750000	---	41.38	54.00	12.62	15000.0	1000.000	H	327.0	25.5

EUT Information

EUT Name: R1LOW-R-SBM
ID: #39
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 2
Operator: Schmidt
Comment: DC 13.5 V

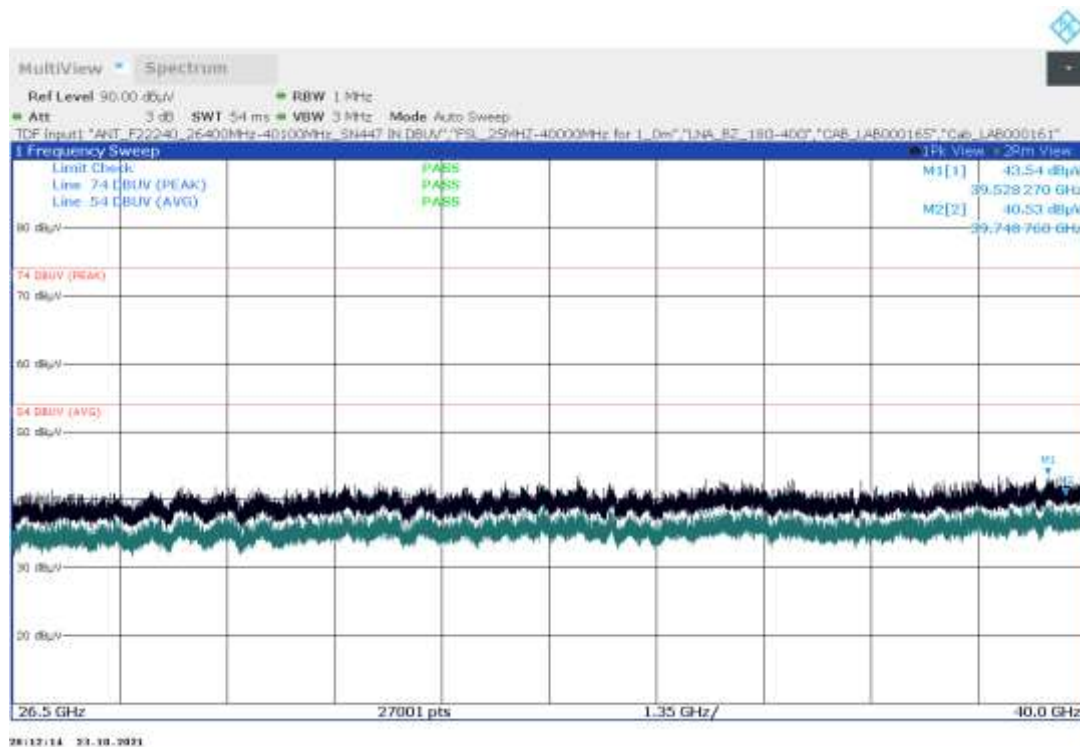
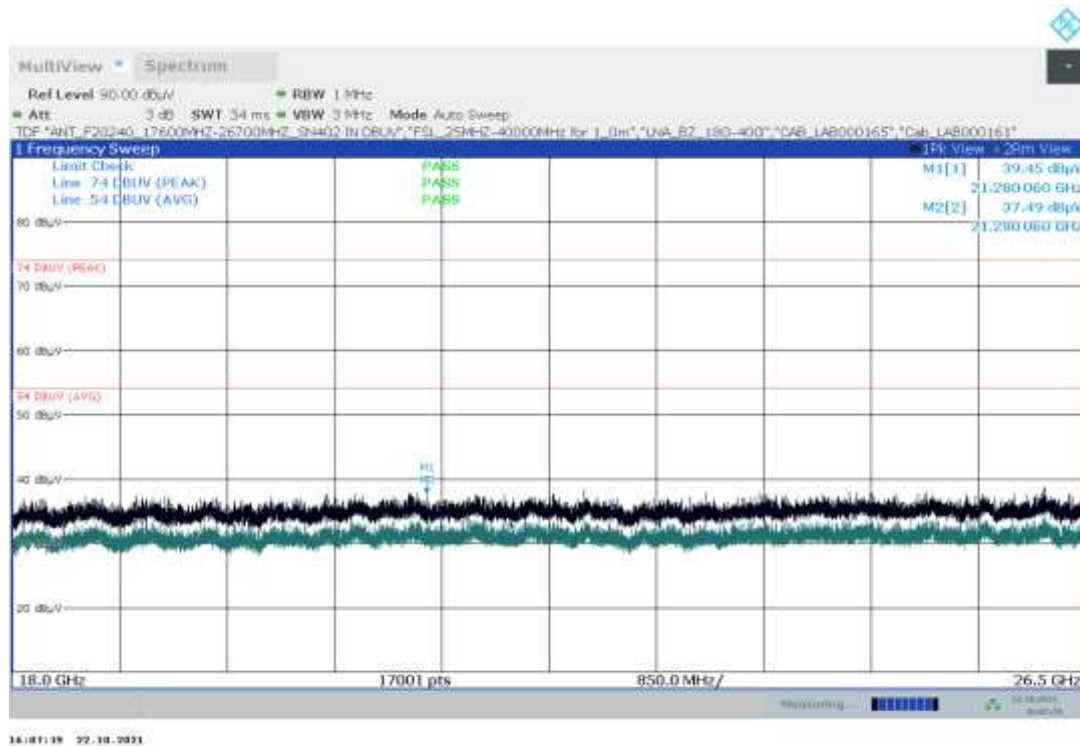
Full Spectrum

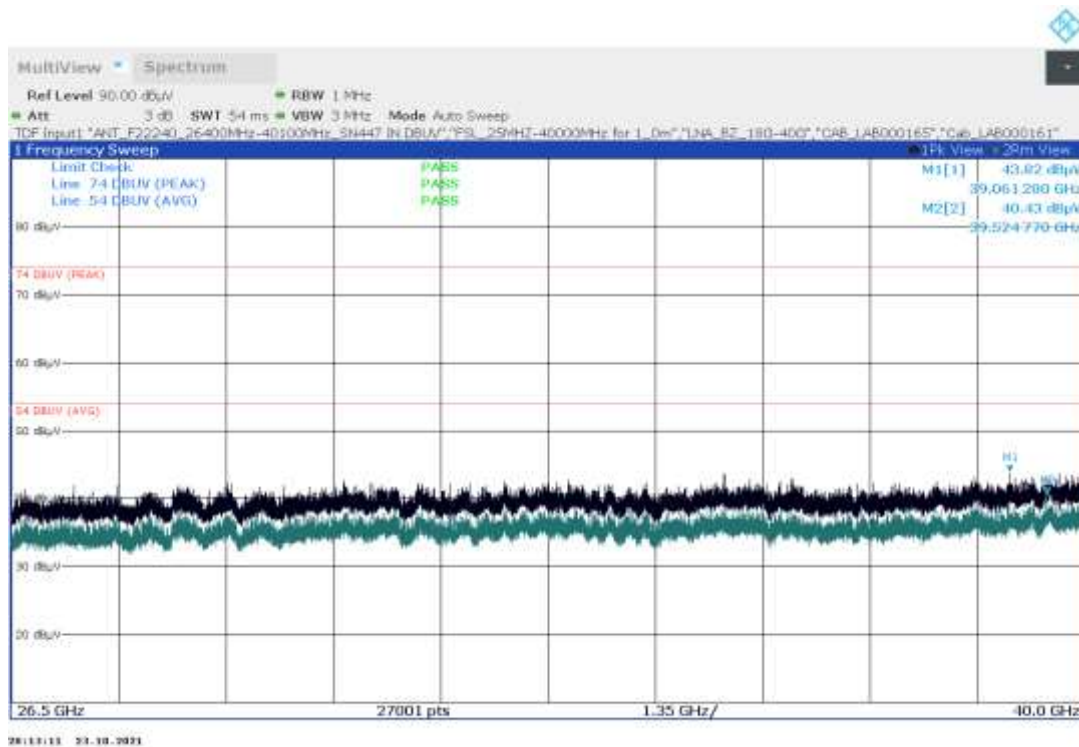
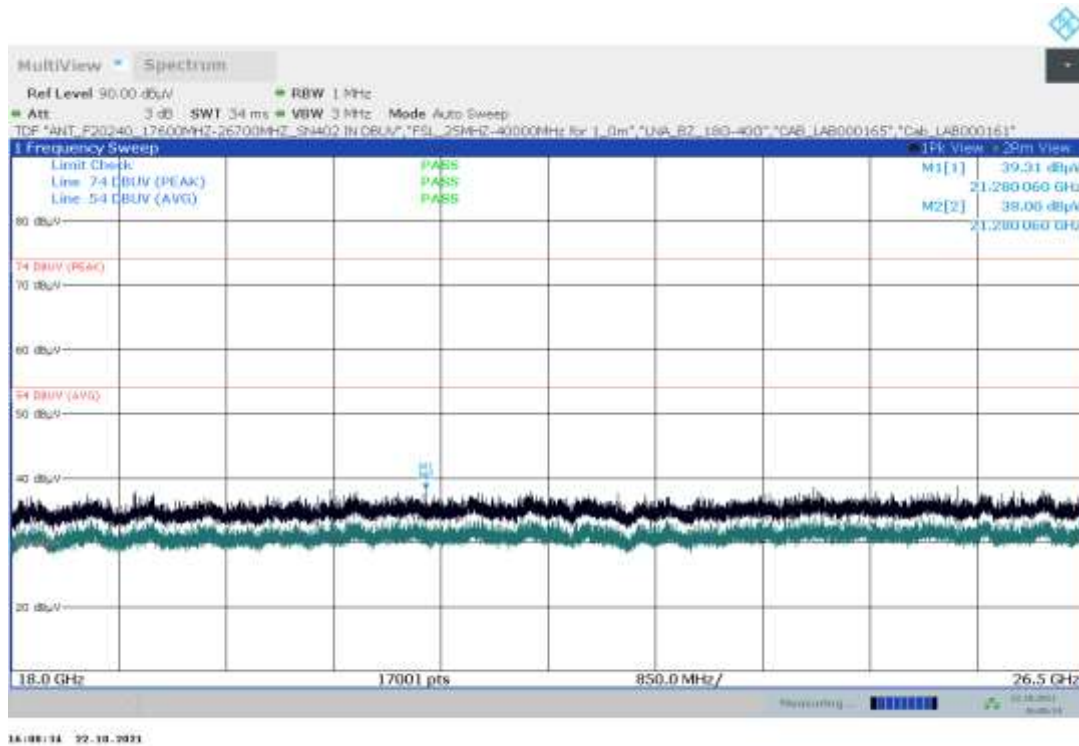


Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1237.000000	45.46	---	74.00	28.54	15000.0	1000.000	V	227.0	-2.7
1237.000000	---	30.38	54.00	23.62	15000.0	1000.000	V	227.0	-2.7
1524.500000	---	26.87	54.00	27.13	15000.0	1000.000	V	38.0	-0.5
1524.500000	53.88	---	74.00	20.12	15000.0	1000.000	V	38.0	-0.5
2078.250000	54.85	---	74.00	19.15	15000.0	1000.000	V	252.0	2.4
2078.250000	---	37.24	54.00	16.76	15000.0	1000.000	V	252.0	2.4
2227.000000	51.37	---	74.00	22.63	15000.0	1000.000	H	216.0	2.3
2227.000000	---	32.59	54.00	21.41	15000.0	1000.000	H	216.0	2.3
3711.000000	---	33.37	54.00	20.63	15000.0	1000.000	V	272.0	8.1
3711.000000	53.23	---	74.00	20.77	15000.0	1000.000	V	272.0	8.1
17199.750000	55.29	---	74.00	18.71	15000.0	1000.000	V	169.0	25.5
17199.750000	---	41.33	54.00	12.67	15000.0	1000.000	V	169.0	25.5

1.3 Electromagnetic radiated emission (18 ... 40 GHz)





END OF ANNEX C

Annex D

Measurement results of EUT D

part of / in addition to

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

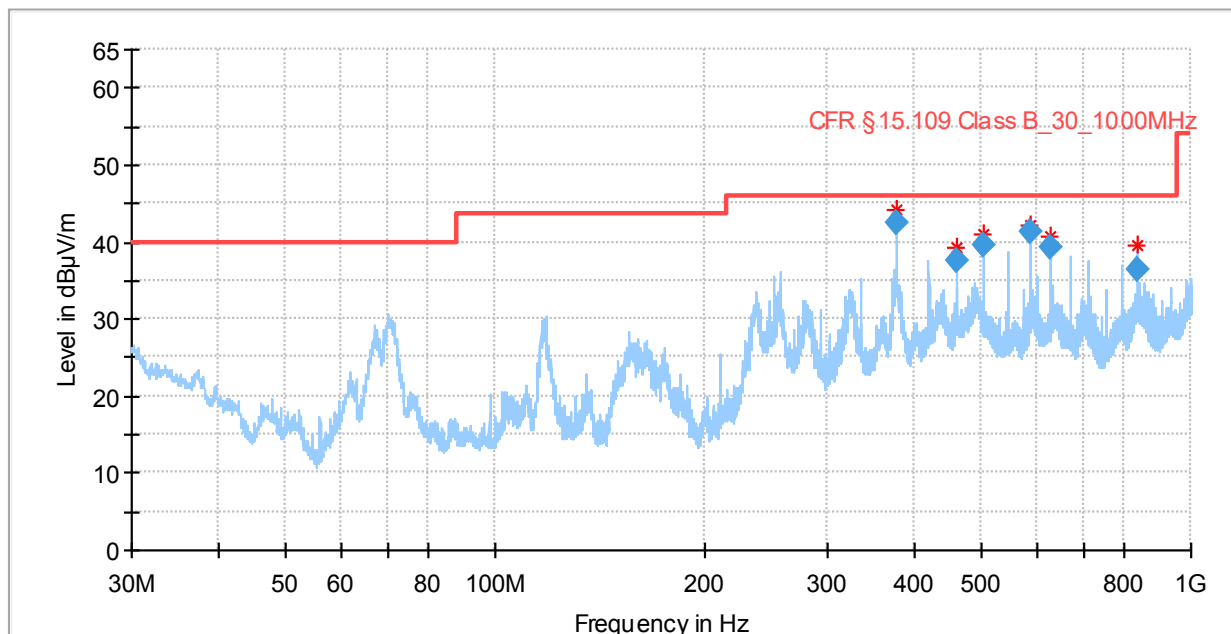
1 Emission tests

1.1 Electromagnetic radiated emission (30 ... 1000 MHz)

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #43
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR §15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

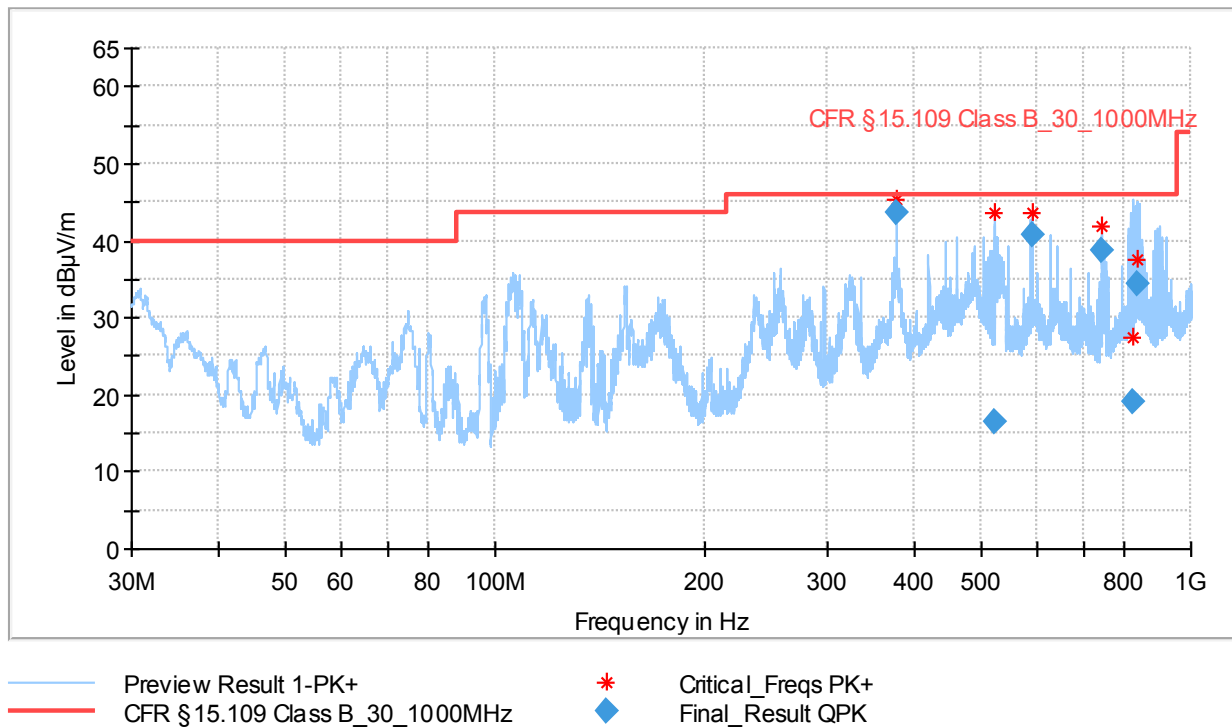
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
378.000000	42.33	46.00	3.67	15000.0	120.000	100.0	H	258.0	15.9
462.000000	37.42	46.00	8.58	15000.0	120.000	100.0	H	146.0	18.0
504.000000	39.45	46.00	6.55	15000.0	120.000	100.0	H	87.0	18.9
588.000000	41.24	46.00	4.76	15000.0	120.000	103.0	H	105.0	20.2
630.000000	39.34	46.00	6.66	15000.0	120.000	100.0	V	236.0	20.6
840.000000	36.49	46.00	9.51	15000.0	120.000	104.0	V	167.0	23.4

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #43
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 2
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



Final_Result

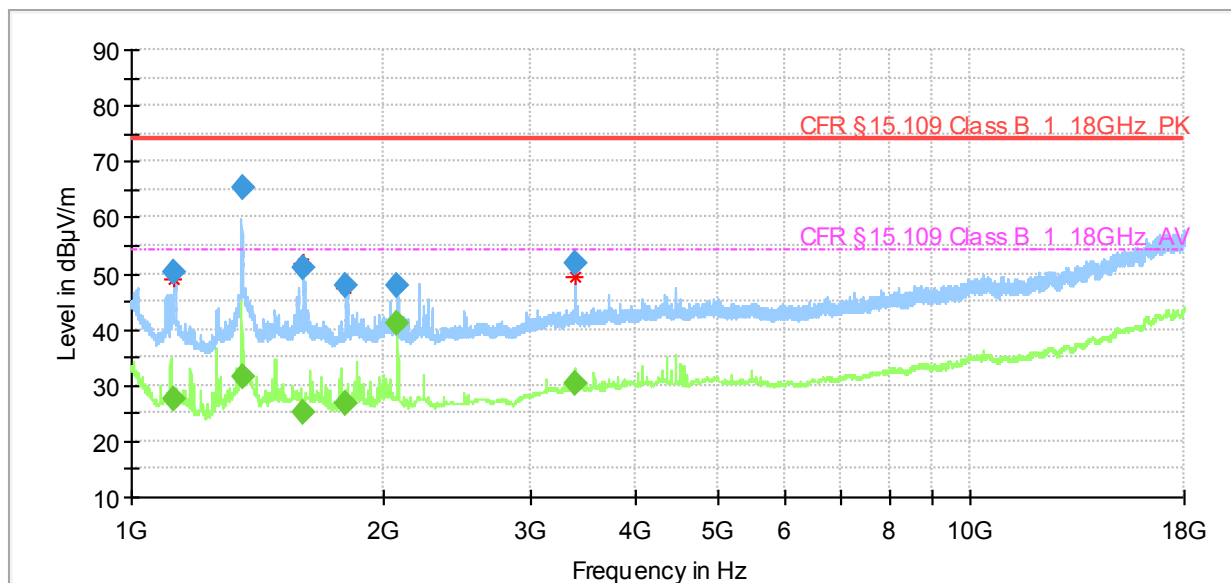
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
378.000000	43.50	46.00	2.50	15000.0	120.000	100.0	H	281.0	15.9
522.870000	16.37	46.00	29.63	15000.0	120.000	130.0	H	167.0	19.0
593.760000	40.81	46.00	5.19	15000.0	120.000	103.0	V	216.0	20.2
742.200000	38.65	46.00	7.35	15000.0	120.000	103.0	V	266.0	22.2
823.020000	19.19	46.00	26.81	15000.0	120.000	113.0	V	114.0	23.4
839.970000	34.49	46.00	11.51	15000.0	120.000	100.0	V	137.0	23.4

1.2 Electromagnetic radiated emission (1 ... 18 GHz)

EUT Information

EUT Name: R1LOW-R-SBM
ID: #43
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 1
Operator: Schmidt
Comment: DC 13.5 V

Full Spectrum



— Preview Result 2-AVG
— Preview Result 1-PK+
* Critical_Freqs PK+
— Critical_Freqs AVG
— CFR §15.109 Class B_1_18GHz_PK
— CFR §15.109 Class B_1_18GHz_AV
◆ Final_Result PK+
◆ Final_Result AVG

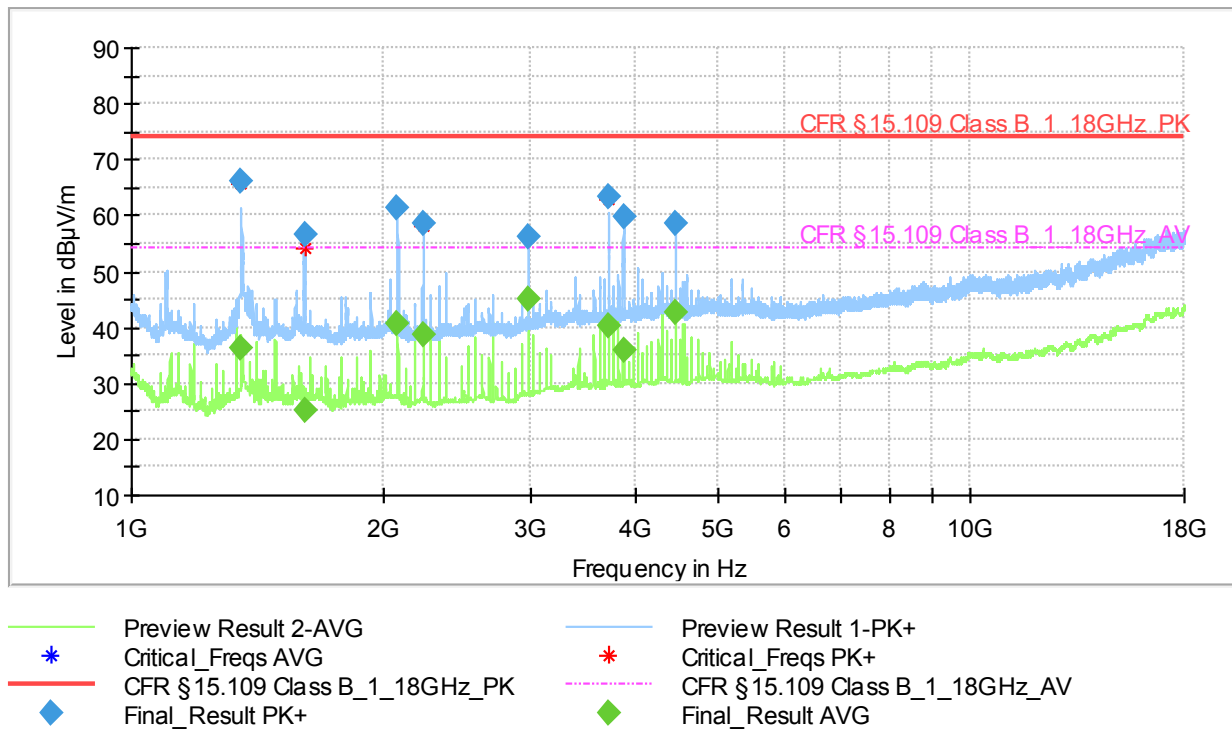
Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1126.750000	---	27.39	54.00	26.61	15000.0	1000.000	H	81.0	-2.9
1126.750000	50.30	---	74.00	23.70	15000.0	1000.000	H	81.0	-2.9
1354.250000	65.51	---	74.00	8.49	15000.0	1000.000	V	14.0	-1.7
1354.250000	---	31.45	54.00	22.55	15000.0	1000.000	V	14.0	-1.7
1604.750000	50.81	---	74.00	23.19	15000.0	1000.000	V	70.0	-0.2
1604.750000	---	25.28	54.00	28.72	15000.0	1000.000	V	70.0	-0.2
1803.250000	47.84	---	74.00	26.16	15000.0	1000.000	H	116.0	0.6
1803.250000	---	26.71	54.00	27.29	15000.0	1000.000	H	116.0	0.6
2078.000000	---	40.89	54.00	13.11	15000.0	1000.000	V	31.0	2.4
2078.000000	47.84	---	74.00	26.16	15000.0	1000.000	V	31.0	2.4
3384.000000	51.69	---	74.00	22.31	15000.0	1000.000	H	111.0	7.0
3384.000000	---	30.42	54.00	23.58	15000.0	1000.000	H	111.0	7.0

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #43
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 2
 Operator: Schmidt
 Comment: DC 13.5 V

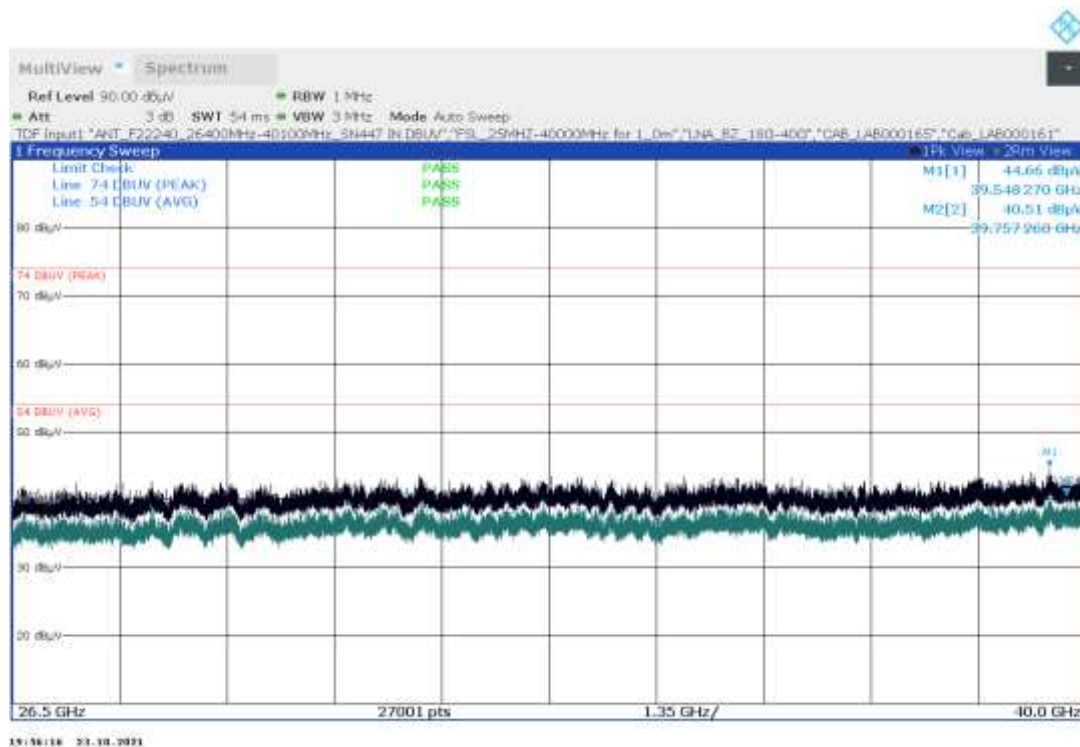
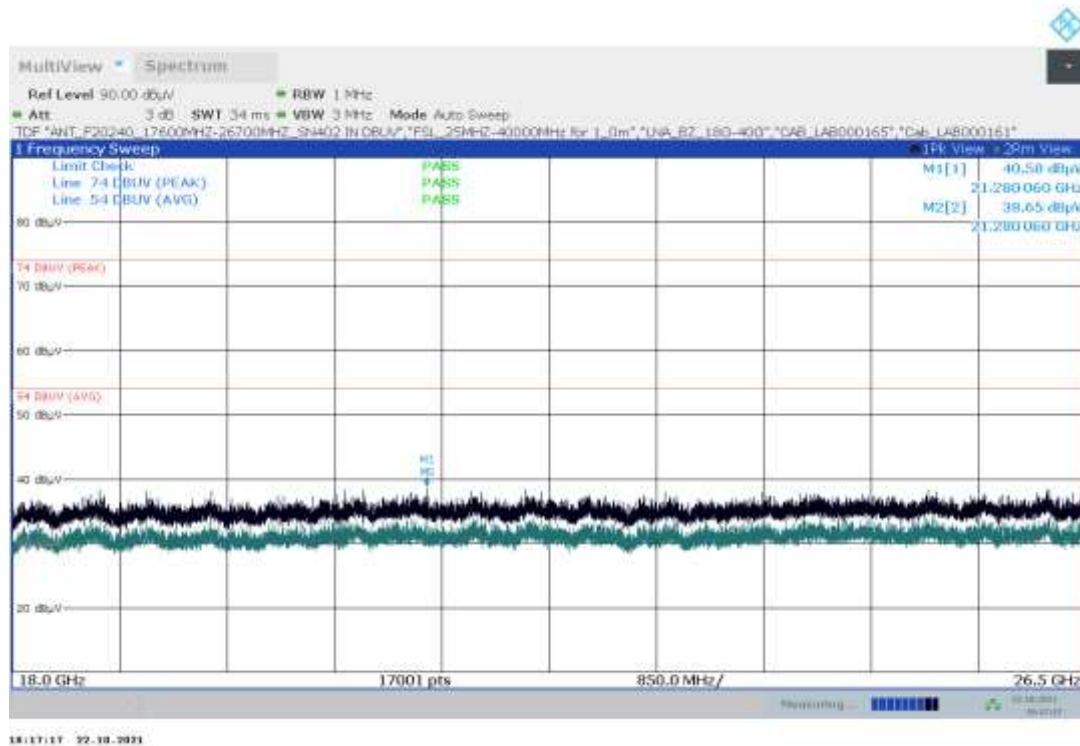
Full Spectrum

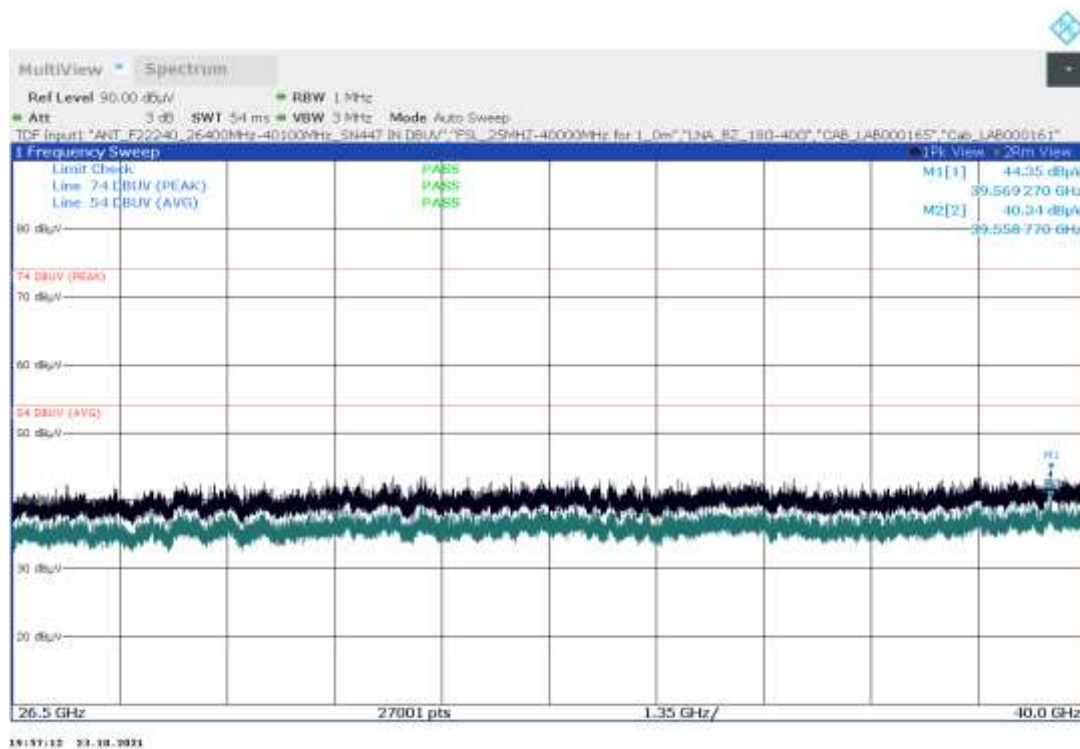
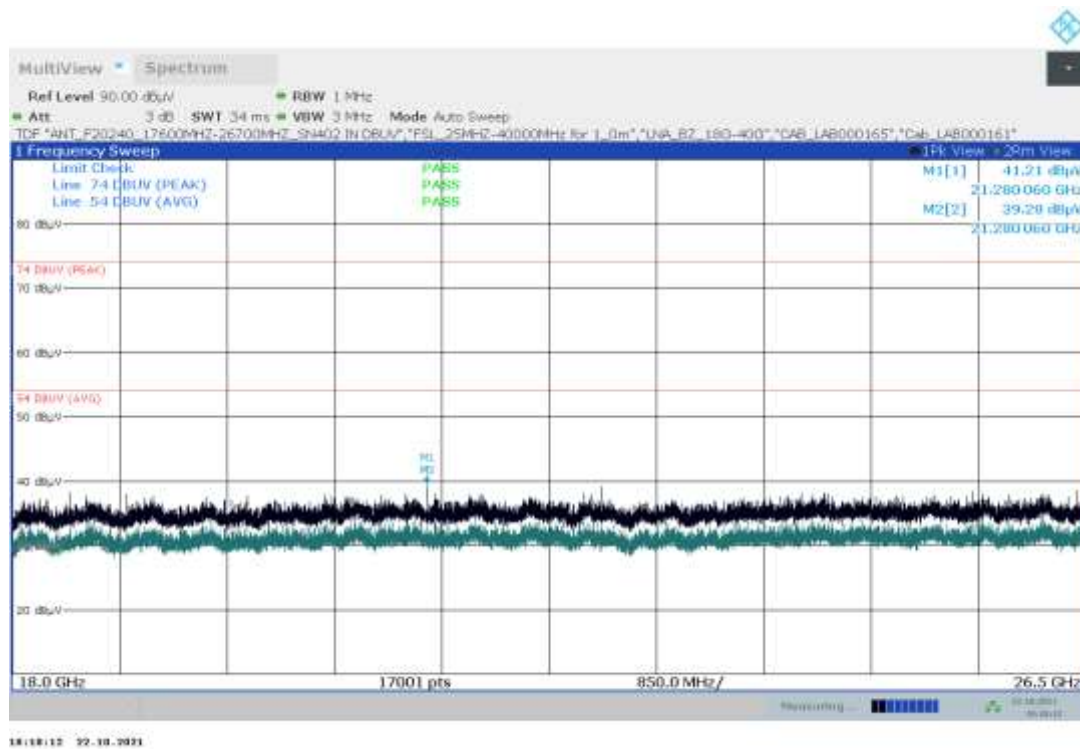


Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1353.250000	66.02	---	74.00	7.98	15000.0	1000.000	V	20.0	-1.7
1353.250000	---	36.19	54.00	17.81	15000.0	1000.000	V	20.0	-1.7
1607.750000	---	25.24	54.00	28.76	15000.0	1000.000	H	293.0	-0.2
1607.750000	56.44	---	74.00	17.56	15000.0	1000.000	H	293.0	-0.2
2078.000000	---	40.75	54.00	13.25	15000.0	1000.000	V	206.0	2.4
2078.000000	61.38	---	74.00	12.62	15000.0	1000.000	V	206.0	2.4
2226.500000	58.43	---	74.00	15.57	15000.0	1000.000	V	232.0	2.3
2226.500000	---	38.61	54.00	15.39	15000.0	1000.000	V	232.0	2.3
2968.500000	---	45.15	54.00	8.85	15000.0	1000.000	V	216.0	5.2
2968.500000	56.36	---	74.00	17.64	15000.0	1000.000	V	216.0	5.2
3711.000000	63.26	---	74.00	10.74	15000.0	1000.000	V	202.0	8.1
3711.000000	---	40.42	54.00	13.58	15000.0	1000.000	V	202.0	8.1
3859.000000	59.84	---	74.00	14.16	15000.0	1000.000	V	214.0	8.6
3859.000000	---	35.79	54.00	18.21	15000.0	1000.000	V	214.0	8.6
4453.000000	---	42.54	54.00	11.46	15000.0	1000.000	H	226.0	9.6
4453.000000	58.71	---	74.00	15.29	15000.0	1000.000	H	226.0	9.6

1.3 Electromagnetic radiated emission (18 ... 40 GHz)





END OF ANNEX D

Annex E

Measurement results of EUT E

part of / in addition to

Test report no.: 21086129-23011-0

Date of issue: 2021-11-17

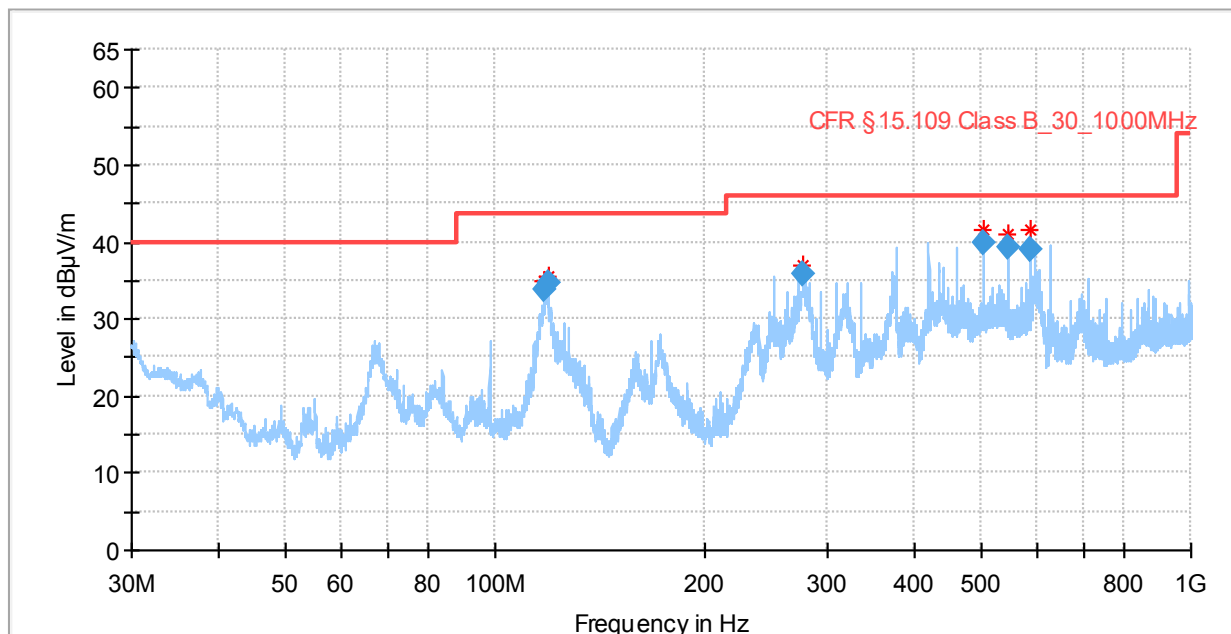
1 Emission tests

1.1 Electromagnetic radiated emission (30 ... 1000 MHz)

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #48
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 1
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



— Preview Result 1-PK+
 — CFR § 15.109 Class B_30_1000MHz

* Critical_Freqs PK+
 ◆ Final_Result QPK

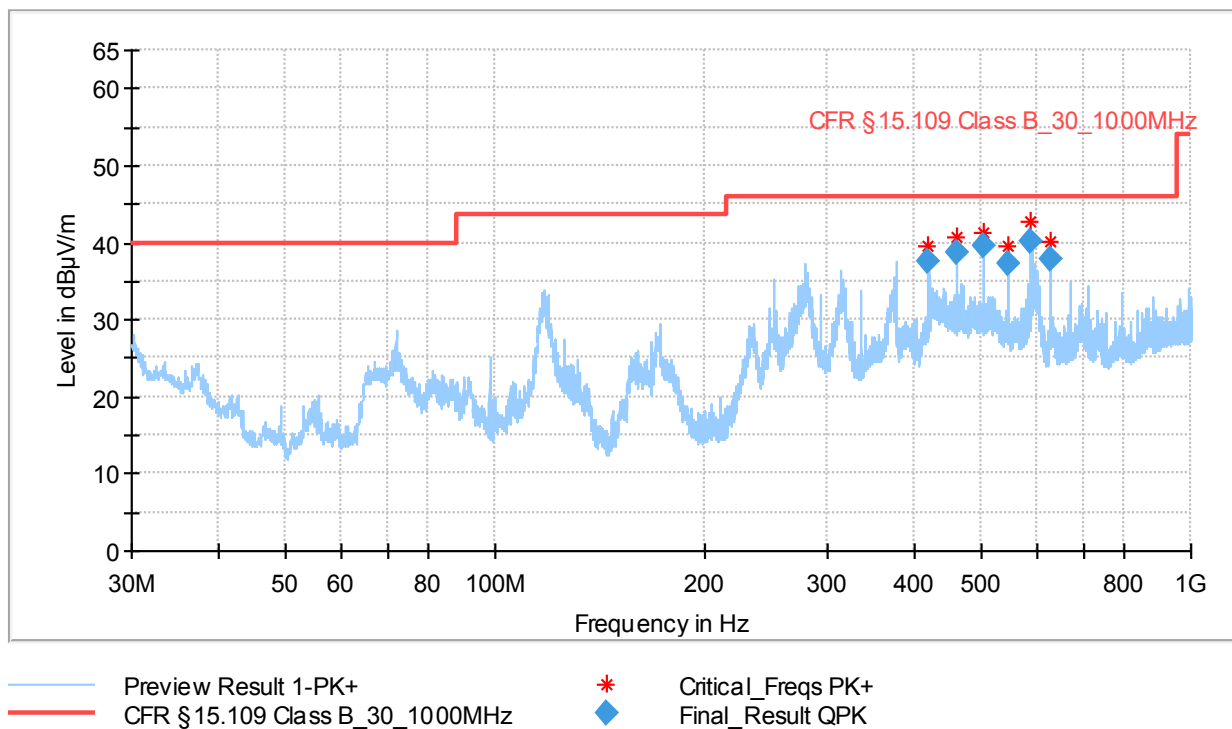
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
117.600000	33.68	43.50	9.82	15000.0	120.000	105.0	V	-16.0	13.0
118.890000	34.54	43.50	8.96	15000.0	120.000	103.0	V	-39.0	12.9
275.910000	35.92	46.00	10.08	15000.0	120.000	100.0	V	269.0	13.1
504.000000	39.82	46.00	6.18	15000.0	120.000	104.0	H	0.0	18.9
546.000000	39.40	46.00	6.60	15000.0	120.000	104.0	H	0.0	19.3
588.000000	39.09	46.00	6.91	15000.0	120.000	105.0	V	141.0	20.2

EUT Information

EUT Name: R1LOW-R-SBM
 ID: #48
 Manufacturer: Mitsubishi Electric Corporation Sanda Works
 Operating mode: op. 2
 Operator: Schmidt
 Comment: DC 13.5 V

Full Spectrum



Final Result

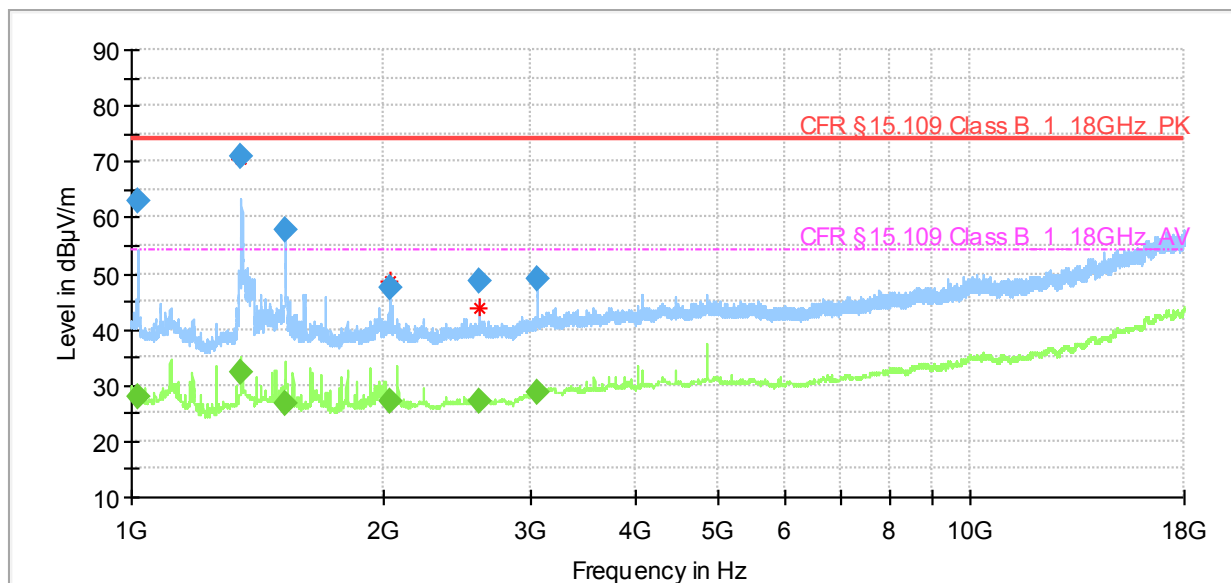
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
420.000000	37.54	46.00	8.46	15000.0	120.000	100.0	H	36.0	17.0
462.000000	38.79	46.00	7.21	15000.0	120.000	100.0	H	0.0	18.0
504.000000	39.47	46.00	6.53	15000.0	120.000	104.0	H	-4.0	18.9
546.000000	37.35	46.00	8.65	15000.0	120.000	103.0	H	-28.0	19.3
588.000000	40.12	46.00	5.88	15000.0	120.000	100.0	H	77.0	20.2
630.000000	37.74	46.00	8.26	15000.0	120.000	126.0	V	175.0	20.6

1.2 Electromagnetic radiated emission (1 ... 18 GHz)

EUT Information

EUT Name: R1LOW-R-SBM
ID: #48
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 1
Operator: Schmidt
Comment: DC 13.5 V

Full Spectrum



— Preview Result 2-AVG
* Critical_Freqs AVG
— CFR §15.109 Class B_1_18GHz_PK
◆ Final_Result PK+

— Preview Result 1-PK+
* Critical_Freqs PK+
— CFR §15.109 Class B_1_18GHz_AV
◆ Final_Result AVG

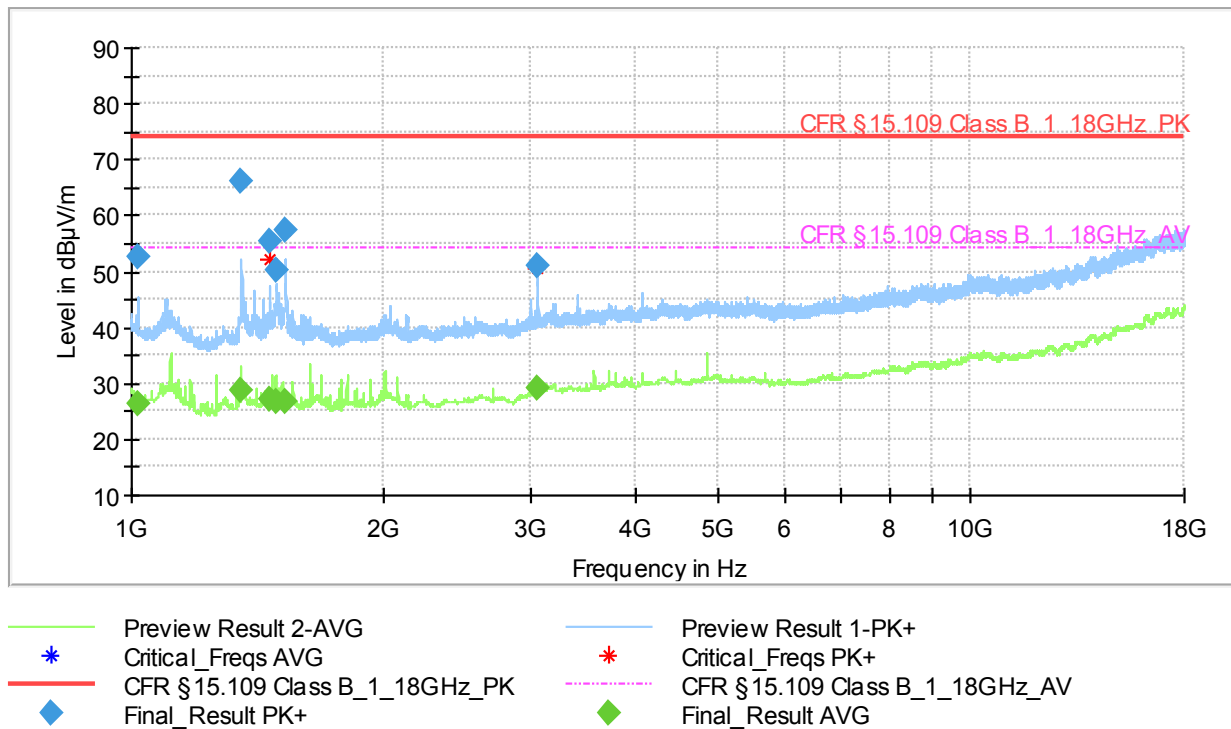
Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1018.000000	63.01	---	74.00	10.99	15000.0	1000.000	V	57.0	-3.0
1018.000000	---	27.73	54.00	26.27	15000.0	1000.000	V	57.0	-3.0
1353.500000	70.85	---	74.00	3.15	15000.0	1000.000	V	12.0	-1.7
1353.500000	---	32.14	54.00	21.86	15000.0	1000.000	V	12.0	-1.7
1526.000000	---	26.80	54.00	27.20	15000.0	1000.000	V	44.0	-0.5
1526.000000	57.82	---	74.00	16.18	15000.0	1000.000	V	44.0	-0.5
2030.250000	---	27.09	54.00	26.91	15000.0	1000.000	H	119.0	2.5
2030.250000	47.55	---	74.00	26.45	15000.0	1000.000	H	119.0	2.5
2605.250000	48.60	---	74.00	25.40	15000.0	1000.000	H	296.0	4.1
2605.250000	---	27.09	54.00	26.91	15000.0	1000.000	H	296.0	4.1
3052.750000	48.88	---	74.00	25.12	15000.0	1000.000	V	53.0	6.1
3052.750000	---	28.90	54.00	25.10	15000.0	1000.000	V	53.0	6.1

EUT Information

EUT Name: R1LOW-R-SBM
ID: #48
Manufacturer: Mitsubishi Electric Corporation Sanda Works
Operating mode: op. 2
Operator: Schmidt
Comment: DC 13.5 V

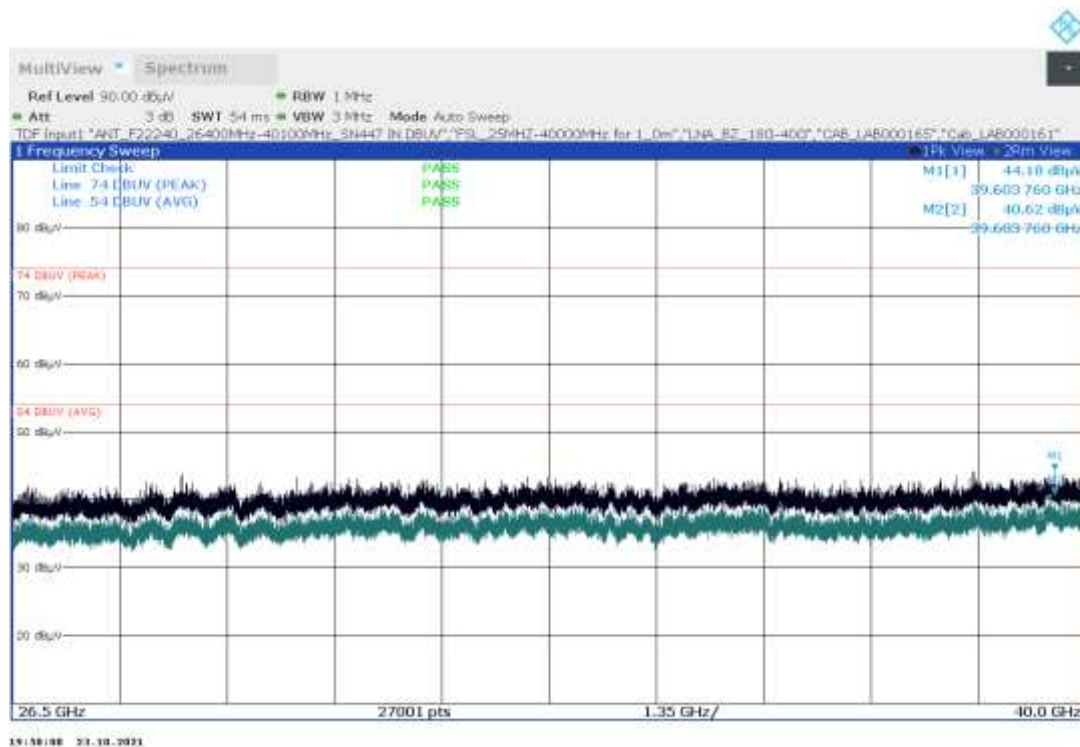
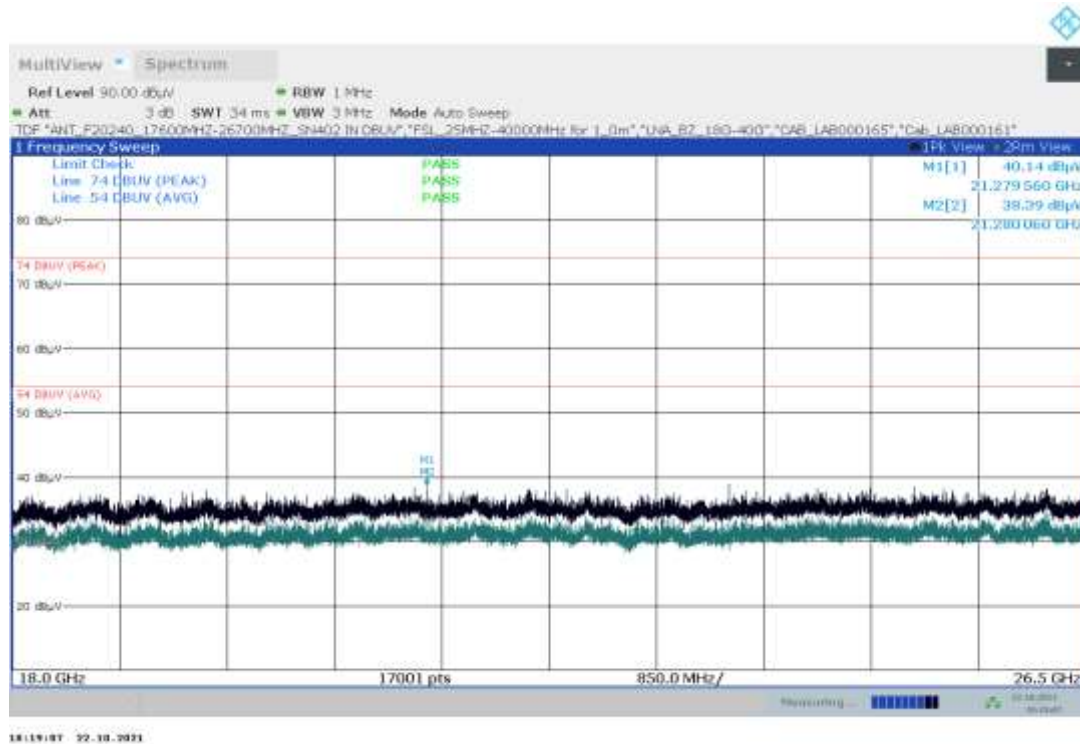
Full Spectrum

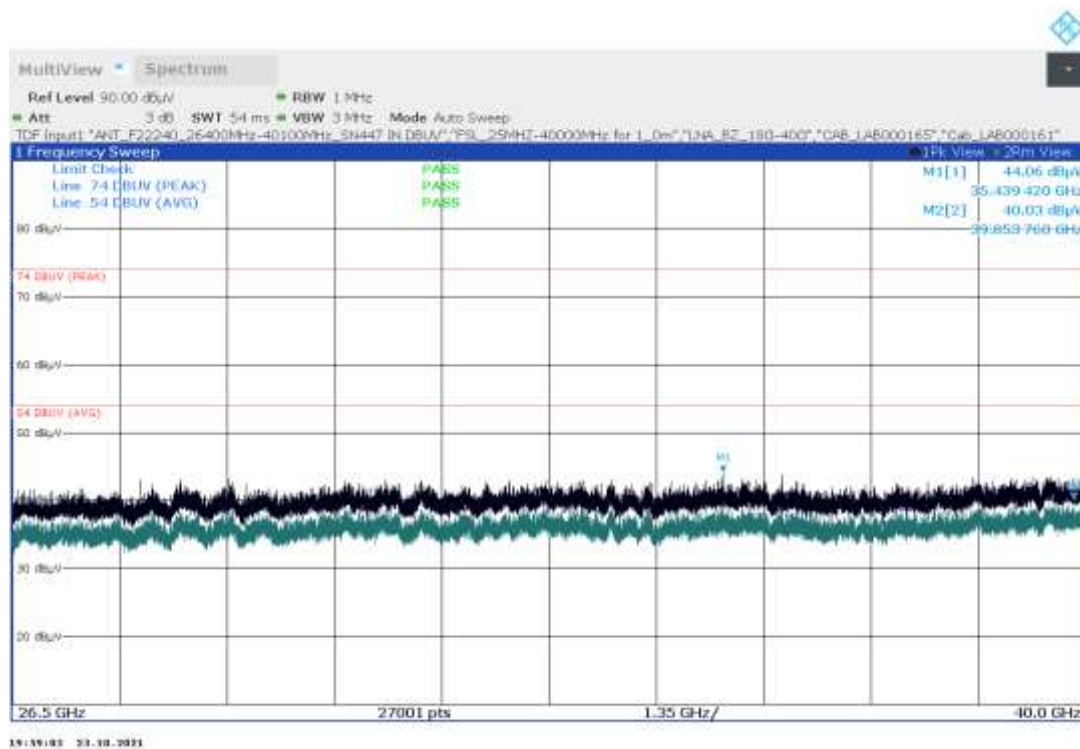
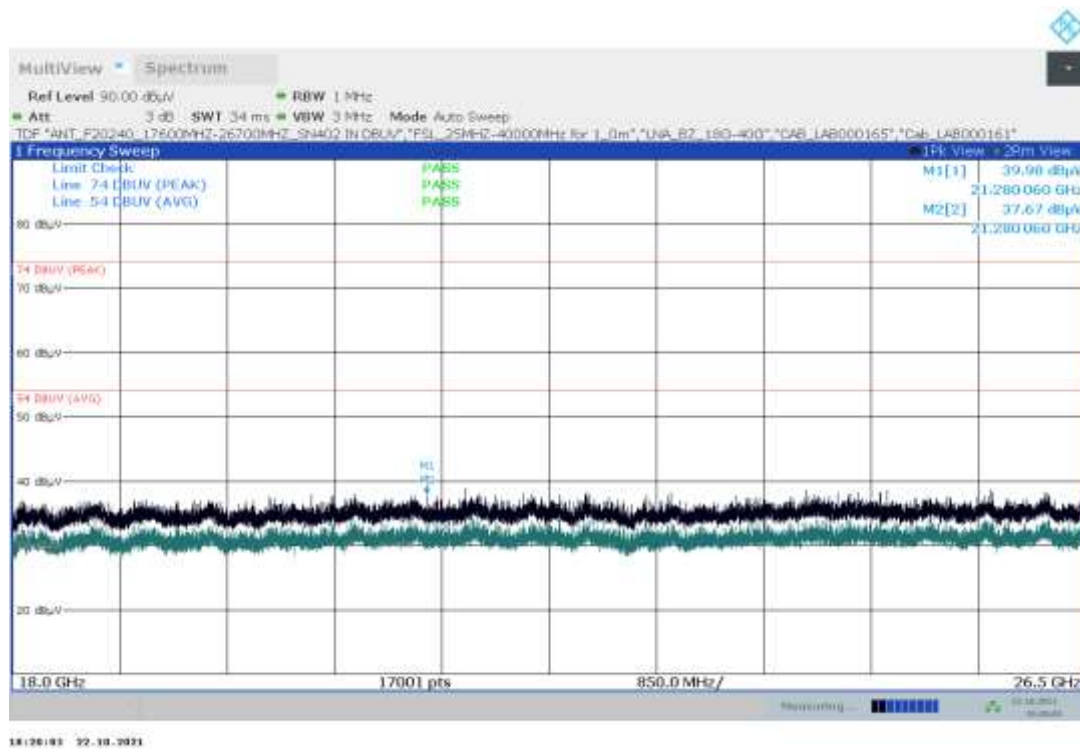


Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
1017.750000	52.44	---	74.00	21.57	15000.0	1000.000	H	270.0	-3.0
1017.750000	---	26.14	54.00	27.86	15000.0	1000.000	H	270.0	-3.0
1353.250000	66.14	---	74.00	7.86	15000.0	1000.000	H	32.0	-1.7
1353.250000	---	28.69	54.00	25.31	15000.0	1000.000	H	32.0	-1.7
1462.500000	55.42	---	74.00	18.58	15000.0	1000.000	V	23.0	-1.1
1462.500000	---	27.10	54.00	26.90	15000.0	1000.000	V	23.0	-1.1
1490.250000	---	26.85	54.00	27.15	15000.0	1000.000	V	35.0	-0.8
1490.250000	50.37	---	74.00	23.63	15000.0	1000.000	V	35.0	-0.8
1526.500000	57.44	---	74.00	16.56	15000.0	1000.000	H	304.0	-0.5
1526.500000	---	26.53	54.00	27.47	15000.0	1000.000	H	304.0	-0.5
3052.500000	---	29.14	54.00	24.86	15000.0	1000.000	V	32.0	6.1
3052.500000	51.05	---	74.00	22.95	15000.0	1000.000	V	32.0	6.1

1.3 Electromagnetic radiated emission (18 ... 40 GHz)





END OF ANNEX E