EMC Test Report

According to

Title 47 CFR Part 15 Subpart B

ISED ICES-Gen Issue 1; Amendment 1 (February 2021)

ISED ICES-003 Issue 7

ANSI C63.4:2014+A1:2017

DUT Name:	KALLOS
Model No. :	KALLOS
Customer:	Intrex Inc
Address:	1896 Preston White Drive, 20191, Reston, VA, United States
Summary:	IN COMPLIANCE
Date of Reception:	8.4.2024
Date(s) of Test(s):	18.4.2024 – 26.4.2024

Tested by (Test Engineer)

Pekka Pulkkinen

Approved by (Technical Manager)

Jukka Rauma

Contents

Document Version History	Date of issue	Comments	Approved by
v0.1	7.6.2024	Initial version	
v1.0	18.6.2024	Approved version	Jukka Rauma

1. General Information

Test Engineer(s): Pekka Pulkkinen

Location:

Test Firm Name	Eurofins Electric & Electronics Finland Oy (EEEF)
Test Site	Yrttipellontie, Peltola
Address of Test Site	Yrttipellonte 6, 90230 Oulu, Finland
FCC Designation number	FI0008
FCC site registration number	771880
ISED number	29576
CAB Identifier	T290

Customer: Intrex Inc

1896 Preston White Drive, 20191, Reston, VA, United States

Ted Tzirimis

Tel : +17034833255

E-mail : ted@intrexis.com

Climate Conditions: Temperature: 15 - 35 °C

Air pressure: 860 - 1060 hPa

Humidity: 30-60 rH%

These limits were not exceeded during testing.

2. Test Samples

General description:

Product is a battery operated single wearable deice to provide nurse call, real-time location, fall detection and access control. Product is one device in Rythmos+ community system, safety and wellness solution for senior communities.

Test samples:

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
3941ER004	MRD_04_01_1	Intrex Inc	Wearable safety and wellness device	KALLOS	MRD_04	2024.03.1x.1	
3941ER008	MRD_CHG_02_0	Intrex Inc	Charcing adapter	CHRG_1	MRD_CHG_02	NA	

Accessories / Monitoring devices:

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version	Comments
3941ER009	NA	Apple	Power adapter	A2118	NA	NA	
3941ER010	NA	NA	USB-A to USB-C cable, 0.5m	NA	NA	NA	

3. Configuration and Operation Modes

Operation Mode	Description
OM1	EUT on in battery mode. LTE CatM1 B2 in IDLE mode (worst case), accerometer active, nRF52832 Bluetooth LE RX active and nRF5340 in advertising mode. Test mode was configurated by custo'er's Maradona-type-approval-testing.py software. nRF52832 radio commands are given over nRF5340 (nRF5340 continues to broadcast advertising messages)
OM2	EUT on in charging mode. LTE CatM1 B2 in IDLE mode (worst case), accerometer active, nRF52832 Bluetooth LE RX active and nRF5340 in advertising mode. Test mode was configurated by customer's Maradona-type-approval-testing.py software. nRF52832 radio commands are given over nRF5340 (nRF5340 continues to broadcast advertising messages)

4. Test sample description

Model	KALLOS	
Additional model(s)	KALLOS	
Brand name	Rythmos	
FCC ID	2AWYMKALLOS	
IC	31261-KALLOSNA01	
Class	Class B	
Radio module	Type	Bluetooth LE radio
	Model	nRF52832
	Manufacturer	Nordic Semiconductor
	FCC-ID	2AWYMKALLOS
	IC	31261-KALLOSNA01
Antenna	Type	Amphenol LDS, gain -8.95 dBi
Radio module	Type	Bluetooth LE radio
	Model	nRF5340
	Manufacturer	Nordic Semiconductor
	FCC-ID	2AWYMKALLOS
	IC	31261-KALLOSNA01
Antenna	Type	Amphenol LDS, gain -8.95 dBi
Radio module	Type	LTE radio module
	Model	BG77
	Manufacturer	Quectel
	FCC-ID	XMR201912BG77
	IC	10224A-201912BG77
Antenna	Type	Amphenol LDS, gain -7.4 dBi

Manufacturer	Intrex Inc 1896 Preston White Drive, 20191, Reston, VA, United States

Ports	**Port**				**Cable**		
	Name and description			Shielded	Specified max length [m]	Attached during test	
				☐		☐	
				☐		☐	
				☐		☐	
				☐		☐	
				☐		☐	
Supplementary information to the ports							
Rated power supply	Voltage and Frequency				Reference poles		
					L1	N	PE
	☒	AC 230 V ☒ 50 Hz ☐ 60 Hz			☐	☐	☐
	☐	AC 240 V ☐ 50 Hz ☐ 60 Hz			☐	☐	☐
	☒	AC 110 V ☐ 50 Hz ☒ 60 Hz			☐	☐	☐
	☐	AC 100 V ☐ 50 Hz ☐ 60 Hz			☐	☐	☐
	☐	Other:			☐	☐	☐
	☐	DC:					
Rated Power	Battery powered: 3.7V						
Clock frequencies	Lowest: 32,786 kHz, highest: 2200 MHz						
Other parameters							
Dimensions in cm (W x H x D)	Diameter 4.5 cm, height 1.2 cm						
Weight	0,051 kg						
Mounting position	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Wearable device					

5. Test description

5.1. FCC subpart 15B and ICES-003, radiated emission test procedure

Radiated tests were performed in a semi-anechoic chamber that has met NSA requirements (4 dB tolerance) according to

- CISPR 16-1-4 Ed. 4.0 2019-01 Validation of a SAC (6.8) using the Reference Site Method (RSM) (6.6);
- ANSI C63.4a -2017 Validation of radiated emission test sites (30MHz – 1 GHz) (Annex D)

sVSWR requirements (1 -18 GHz) are met according to

- CISPR 16-1-4 Ed. 4.0 2019-01 SVSWR site validation – standard test procedure (7, 7.6)

2 different measurement antenna was used, located at a distance of 3 m.

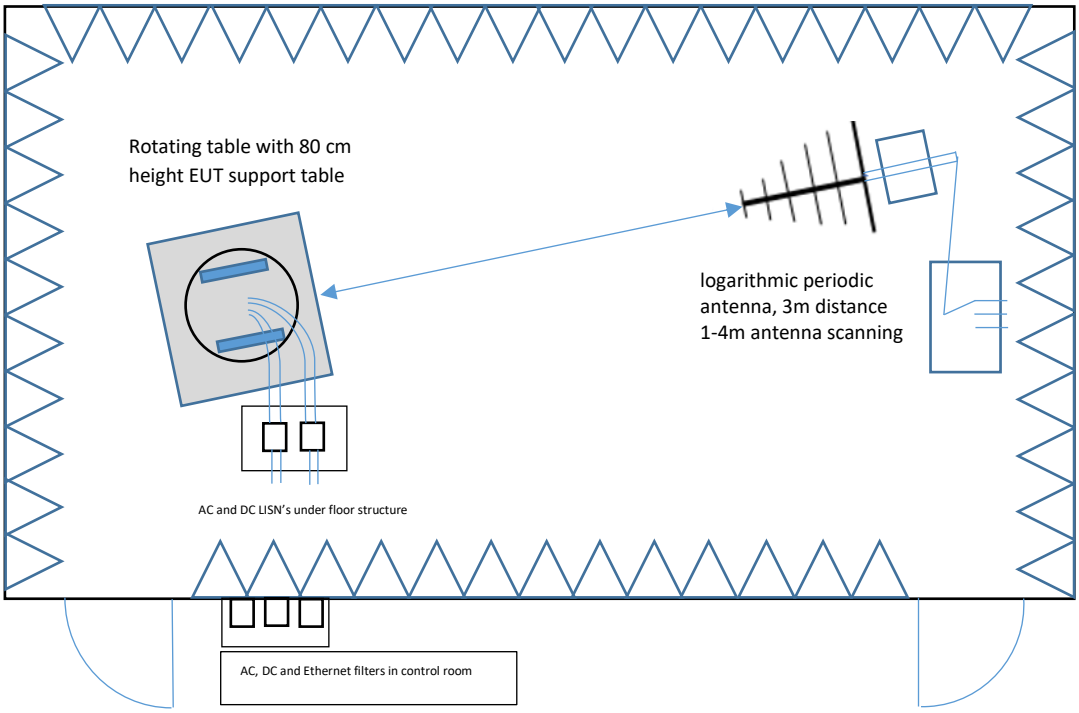
- linear polarized logarithmic periodic antenna for frequency range 30-1000 MHz
- and double-ridged horn antenna for the frequency range 1-18 GHz

The equipment under test was set up on a non-conductive support, 80 cm above the ground plane. EUT power supply LISN's for AC and DC were located under the ground reference plane. The field strength was calculated by adding correction factor to the measured level from the EMI receiver. This correction factor includes antenna factor, cable loss and pre-amplifier gain**.**

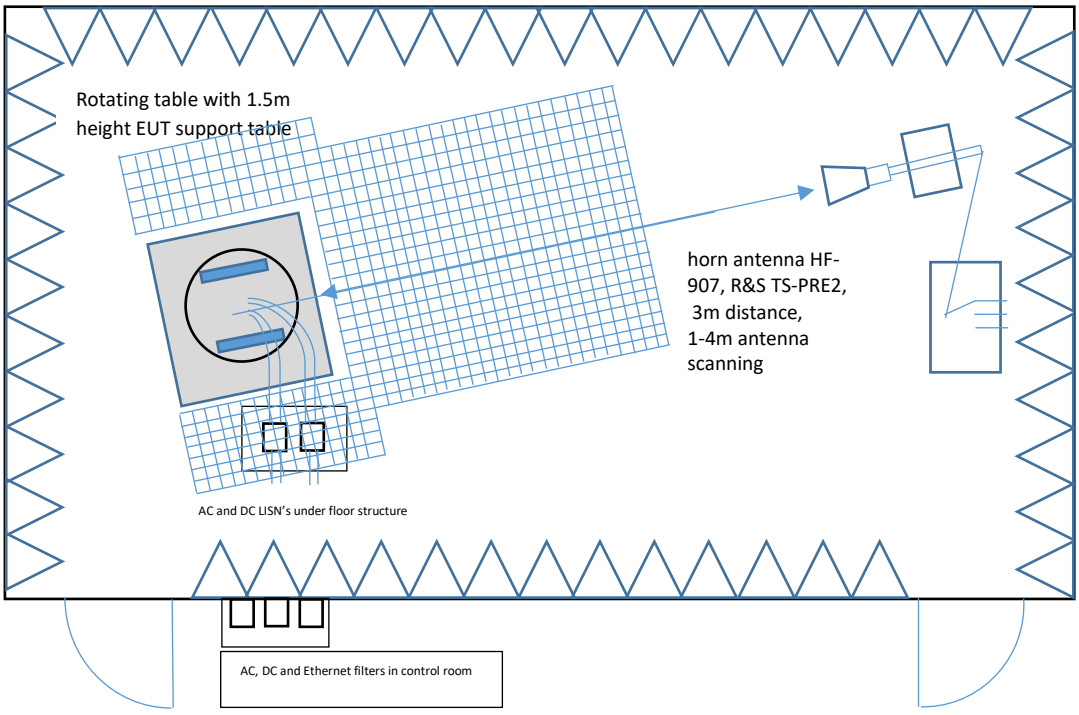
Measurement procedure

- EUT was set in a manner that is most representative of the equipment as typically used (i.e., as specified in the EUT instruction manual)
    - In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the orientation (attitude) having maximum or near-maximum emission level.
- in exploratory measurements for full frequency range
    - turntable was rotated with 45° steps (from 0° to 315°)
    - measurement was done in both vertical and horizontal antenna polarization with antenna height of 1m
    - measurement was done with peak detector to find the frequencies of maximum emissions and at least six highest peaks related to the limits were chosen
- these peak values were further maximized by scanning the turntable position 0 to 360 degrees and the antenna height 1 to 4m
- for maximized values, final measurement was done with
    - quasi-peak detector for 30MHz to 1GHz frequency range
    - with Average detector for 1GHz to 18GHz frequency range

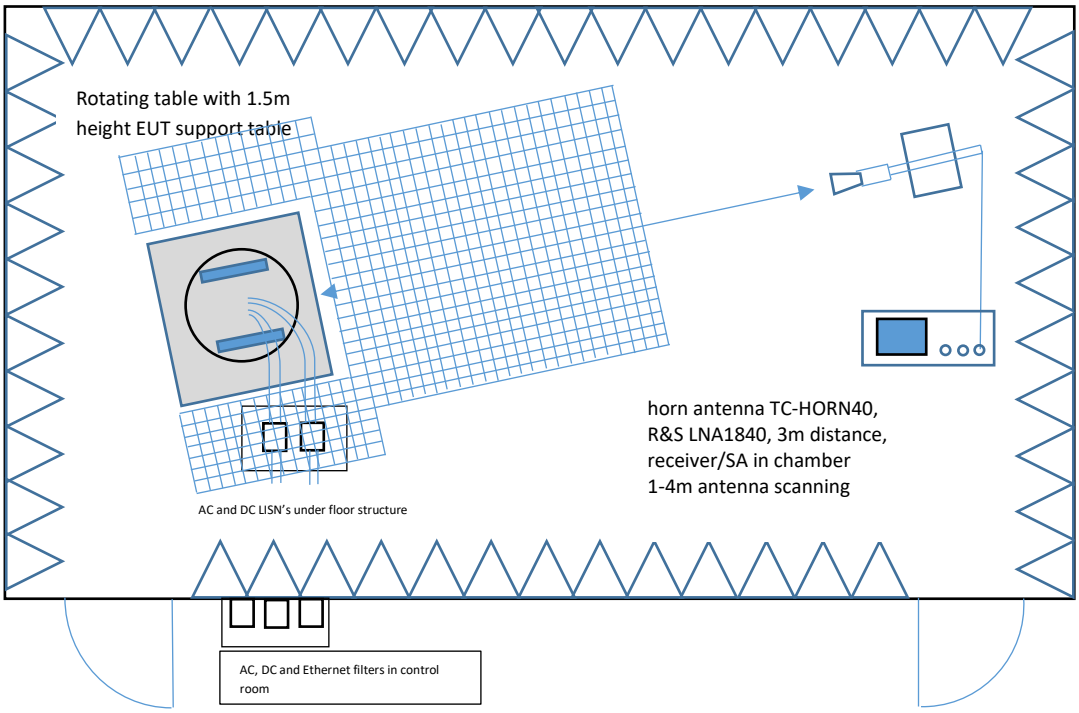
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 18 GHz:



Radiated measurements setup from 18 GHz to 26 / 40 GHz:



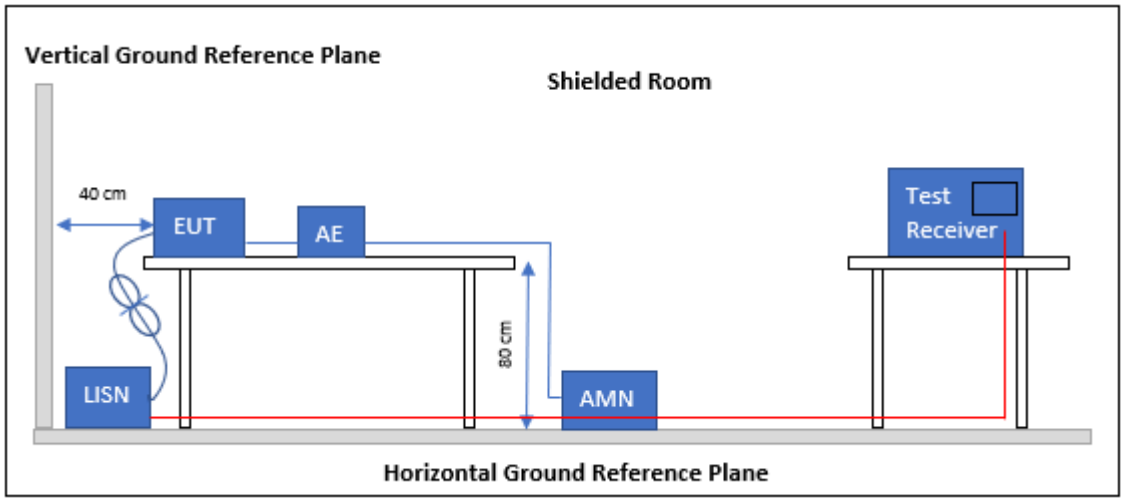
5.2. FCC subpart 15B and ICES-003, conducted emission test procedure

The equipment under test was set up on a non-conductive support, 80 cm above the ground plane and 40 cm distance of vertical ground plane. Test setup is described in pictures below.

Measurement procedure

- EUT was operated in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement
- in exploratory measurements for full frequency range
    - measurement was done with peak and average detector to find the frequencies of maximum emissions for each current-carrying conductor of each power cord associated with the EUT and at least six highest peaks related to the limits were chosen per conductor
    - the one configuration and arrangement and mode of operation that produces the highest emissions related to the limit across all the measured conductors was recorded.
- for this configuration and its maximized values, final measurement for each current-carrying conductor was done with quasi-peak detector and average detector

Conducted emission test setup



6. Uncertainties

6.1. Emission measurement uncertainties

Description	Expanded Uncertainty (k=2)
AC conducted emission	2,24
Radiated emission ≤ 1 GHz	4,62
Radiated emission > 1 GHz	5,72

7. Summary

Title 47 CFR 15B, ISED ICES-003 Issue 7			
Reference	Requirement – Test case	Verdict	Remark
FCC 15.109 ICES-003, 3.2.2	Radiated emission. Electromagnetic field measure (30 MHz – 1000 MHz)	PASS	
FCC 15.109 ICES-003, 3.2.2	Radiated emission. Electromagnetic field measure (1 GHz – 18 GHz)	PASS	
FCC 15.107 ICES-003, 3.2.1	Continuous conducted emission (150 kHz – 30 MHz)	PASS	
The DUT has been tested and passes the FCC Part 15 Subpart B without any mofications.		Yes	
Possible test case verdicts PASS = Test object meet the requirements FAIL = Test object does not meet the requirements N/T = Required by standard but not tested N/R = Not required by standard for the test object			

8. Radiated Emissions

Reference: FCC 15.109, ICES-003, 3.2.2
Test method: ANSI C63.4:2014+A1:2017 Section 8

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B, Secs. 15.109 & ICES-003 Issue 7, section 3.2.2.

FCC part 15, subpart B

Limits, Class B	Quasi-peak Limit for 3m	
Frequency of emission MHz)	(microvolt/meter)	(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

ICES-003, Issue 7

Limits, Class B	Quasi-peak Limit for 3m	
Frequency of emission MHz)	(microvolt/meter)	(dBuV/m)
30-88	100	40
88-216	150	43.5
216-230	200	46
230-960	223	47
Above 960	500	54

FCC part 15, subpart B and ICES-003, Issue 7

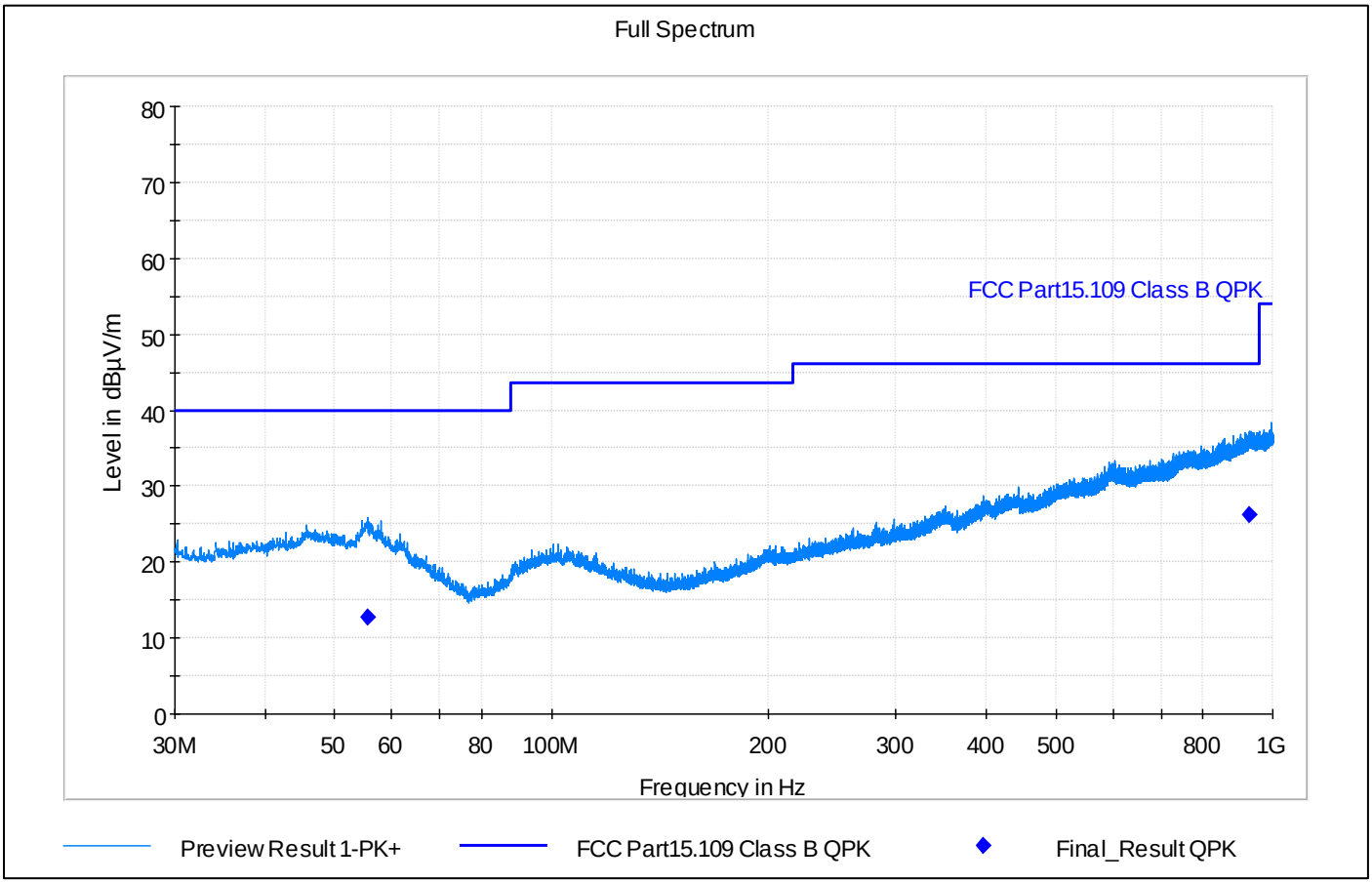
Frequency of emission MHz)	Average Limit for 3m		Peak Limit for 3m
	(microvolt/meter)	(dBuV/m)	(dBuV/m)
Above 1000	500	54	74
Frequencies above 1 GHz, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test, as per §15.35(b			

Tested sample(s): 3941ER004
Operation mode(s) tested: OM1, OM2
Test results: PASS
Note:

Test data:

Operation mode(s)	Configuration	Test Verdict
OM1	3941ER004	PASS
OM2	3941ER004 + 3941ER008 + 3941ER009 + 3941ER010	PASS

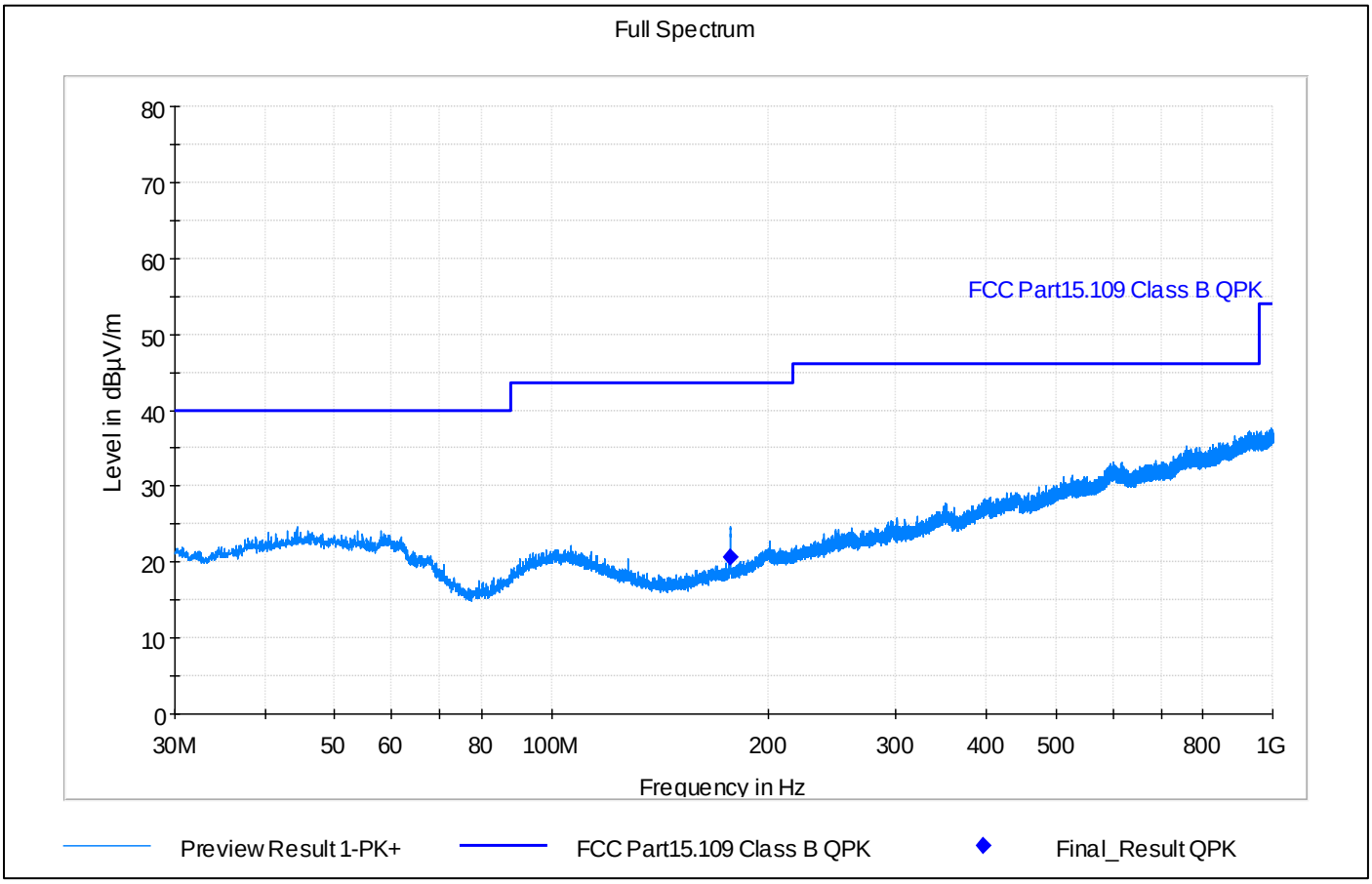
FCC part 15 subpart B & ICES-003, Graph and final result table for 30 MHz – 1 GHz, OM1:



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Comment
55.620000	12.72	40.00	27.28	15000.0	120.000	117.0	V	15.0	0.0	20.7	PASS
929.220000	26.15	46.00	19.85	15000.0	120.000	279.0	H	26.0	0.0	34.0	PASS

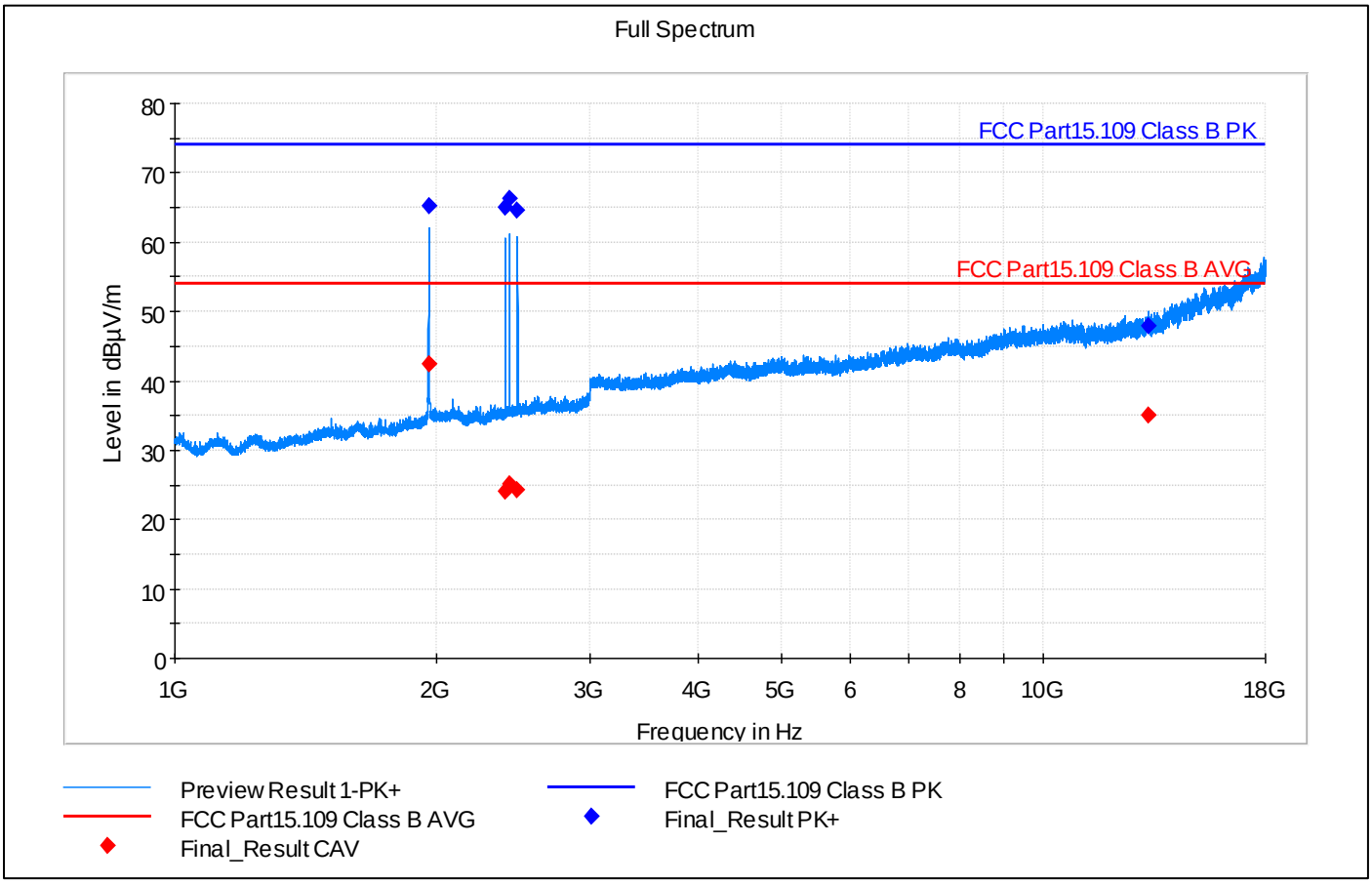
FCC part 15 subpart B & ICES-003, Graph and final result table for 30 MHz – 1 GHz, OM2:



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)	Comment
176.940000	20.58	43.50	22.92	15000.0	120.000	198.0	H	5.0	0.0	17.4	PASS

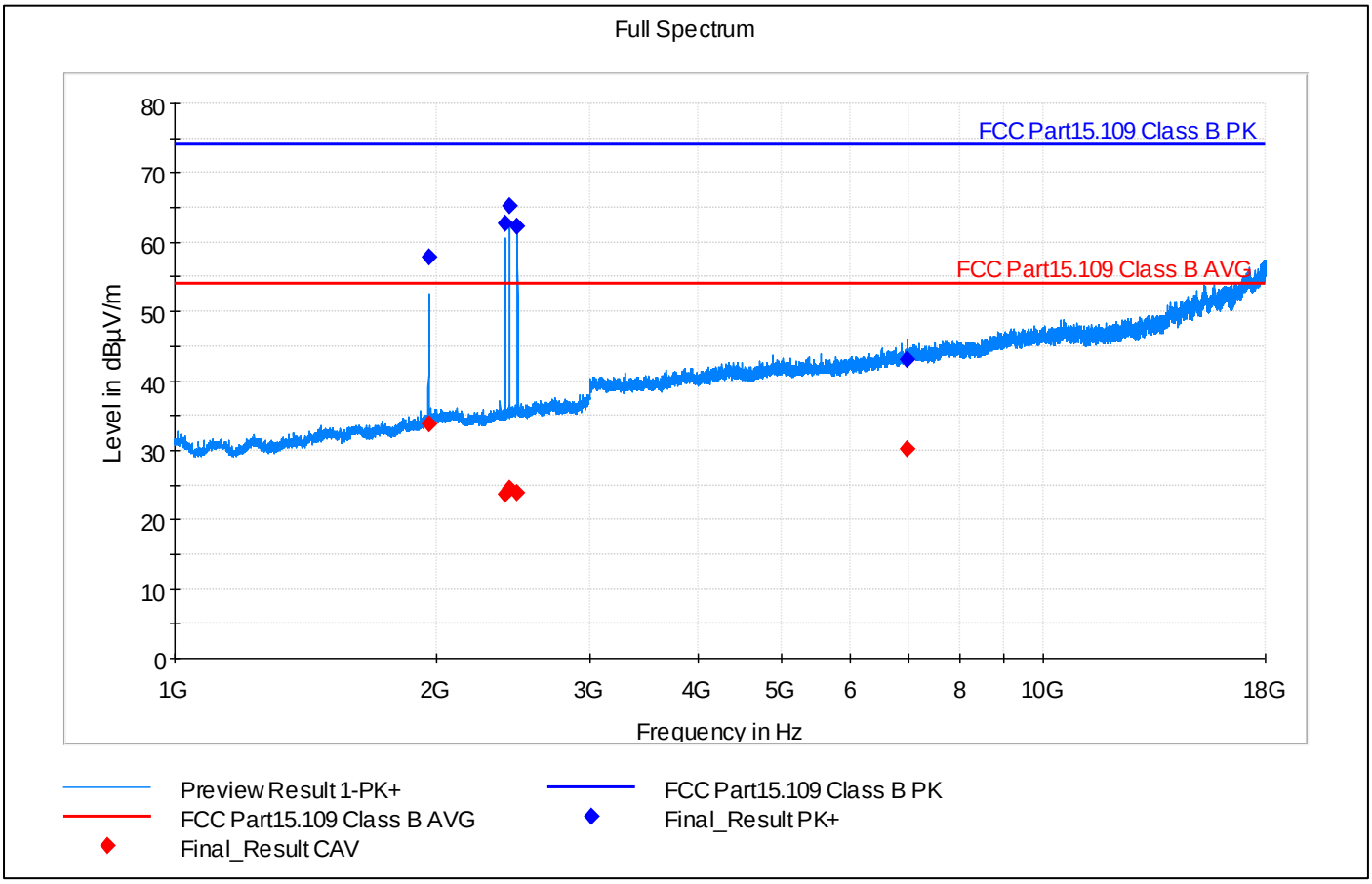
FCC part 15 subpart B & ICES-003, Graph and final result table for 1 GHz – 18 GHz, OM1:



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1959.750000	---	42.49	54.00	11.51	500.0	1000.000	147.0	V	286.0	-1.8	CMW500 LTE B2 DL
1959.750000	65.18	---	74.00	8.82	500.0	1000.000	147.0	V	286.0	-1.8	CMW500 LTE B2 DL
2401.750000	65.10	---	74.00	8.90	500.0	1000.000	345.0	H	179.0	0.1	Wirepas advertising signal
2401.750000	---	24.07	54.00	29.93	500.0	1000.000	345.0	H	179.0	0.1	Bluetooth LE advertising signal
2426.000000	66.31	---	74.00	7.69	500.0	1000.000	339.0	H	177.0	0.2	Bluetooth LE advertising signal
2426.000000	---	25.09	54.00	28.91	500.0	1000.000	339.0	H	177.0	0.2	Bluetooth LE advertising signal
2479.750000	---	24.34	54.00	29.66	500.0	1000.000	395.0	H	45.0	0.4	Bluetooth LE dvertising signal
2479.750000	64.67	---	74.00	9.33	500.0	1000.000	395.0	H	45.0	0.4	Bluetooth LE advertising signal
13225.000000	47.83	---	74.00	26.17	500.0	1000.000	396.0	V	317.0	25.4	PASS
13225.000000	---	35.01	54.00	18.99	500.0	1000.000	396.0	V	317.0	25.4	PASS

FCC part 15 subpart B & ICES-003, Graph and final result table for 1 GHz – X GHz, OM2:



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1960.000000	---	33.79	54.00	20.21	500.0	1000.000	151.0	V	190.0	-1.8	CMW500 LTE B2 DL
1960.000000	57.87	---	74.00	16.13	500.0	1000.000	151.0	V	190.0	-1.8	CMW500 LTE B2 DL
2402.250000	62.65	---	74.00	11.35	500.0	1000.000	278.0	V	224.0	0.1	Bluetooth LE advertising signal
2402.250000	---	23.62	54.00	30.38	500.0	1000.000	278.0	V	224.0	0.1	Bluetooth LE advertising signal
2426.250000	---	24.42	54.00	29.58	500.0	1000.000	285.0	H	204.0	0.2	Bluetooth LE advertising signal
2426.250000	65.31	---	74.00	8.69	500.0	1000.000	285.0	H	204.0	0.2	Bluetooth LE advertising signal
2480.250000	---	23.92	54.00	30.08	500.0	1000.000	227.0	H	220.0	0.4	Bluetooth LE advertising signal
2480.250000	62.28	---	74.00	11.72	500.0	1000.000	227.0	H	220.0	0.4	Bluetooth LE advertising signal
6955.000000	---	30.24	54.00	23.76	500.0	1000.000	400.0	H	142.0	14.3	PASS
6955.000000	43.09	---	74.00	30.91	500.0	1000.000	400.0	H	142.0	14.3	PASS

9. Conducted Emissions, AC mains power port

Reference: FCC 15.107, ICES-003, 3.2.1
Test method: ANSI C63.4:2014+A1:2017 Section 12

The applied limit for continuous conducted emission in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B, Secs. 15.107 & ICES-003 Issue 7

FCC part 15, subpart B and ICES-003, Issue 7

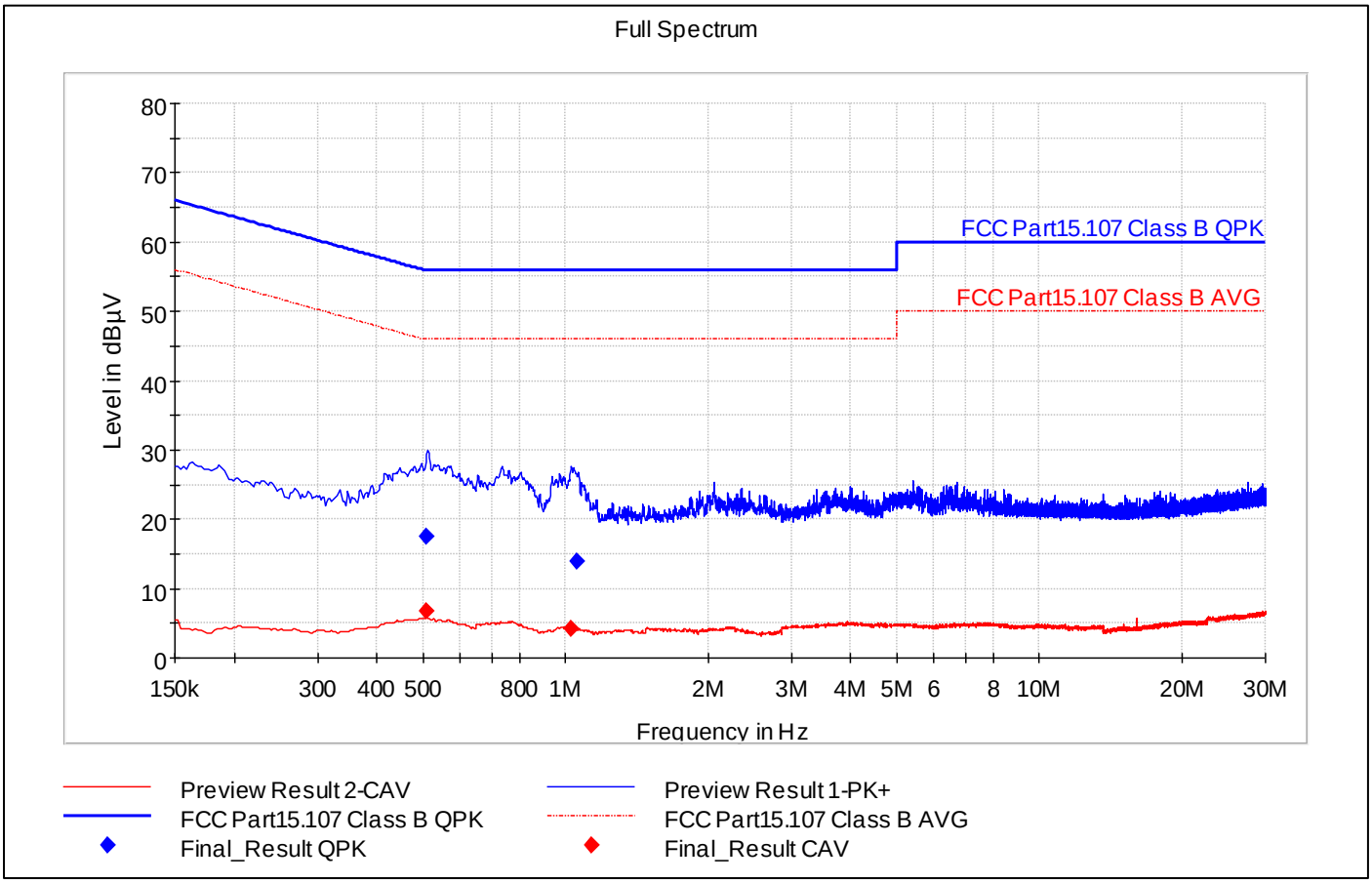
Limits:	Class B (dBuV)	
Frequency	Quasi peak limit	Average limit
0.15 – 0.50 MHz	66 to 56	56 to 46
0.50 – 5 MHz	56	46
5 – 30 MHz	60	50

Tested sample(s): 3941ER004
Operation mode(s) tested: OM2
Test results: PASS
Note:

Test data:

Operation mode(s)	Configuration	Test Verdict
OM2	Neutral wire noise. 3941ER004 + 3941ER008 + 3941ER009 + 3941ER010	PASS
OM2	Phase wire noise. 3941ER004 + 3941ER008 + 3941ER009 + 3941ER010	PASS

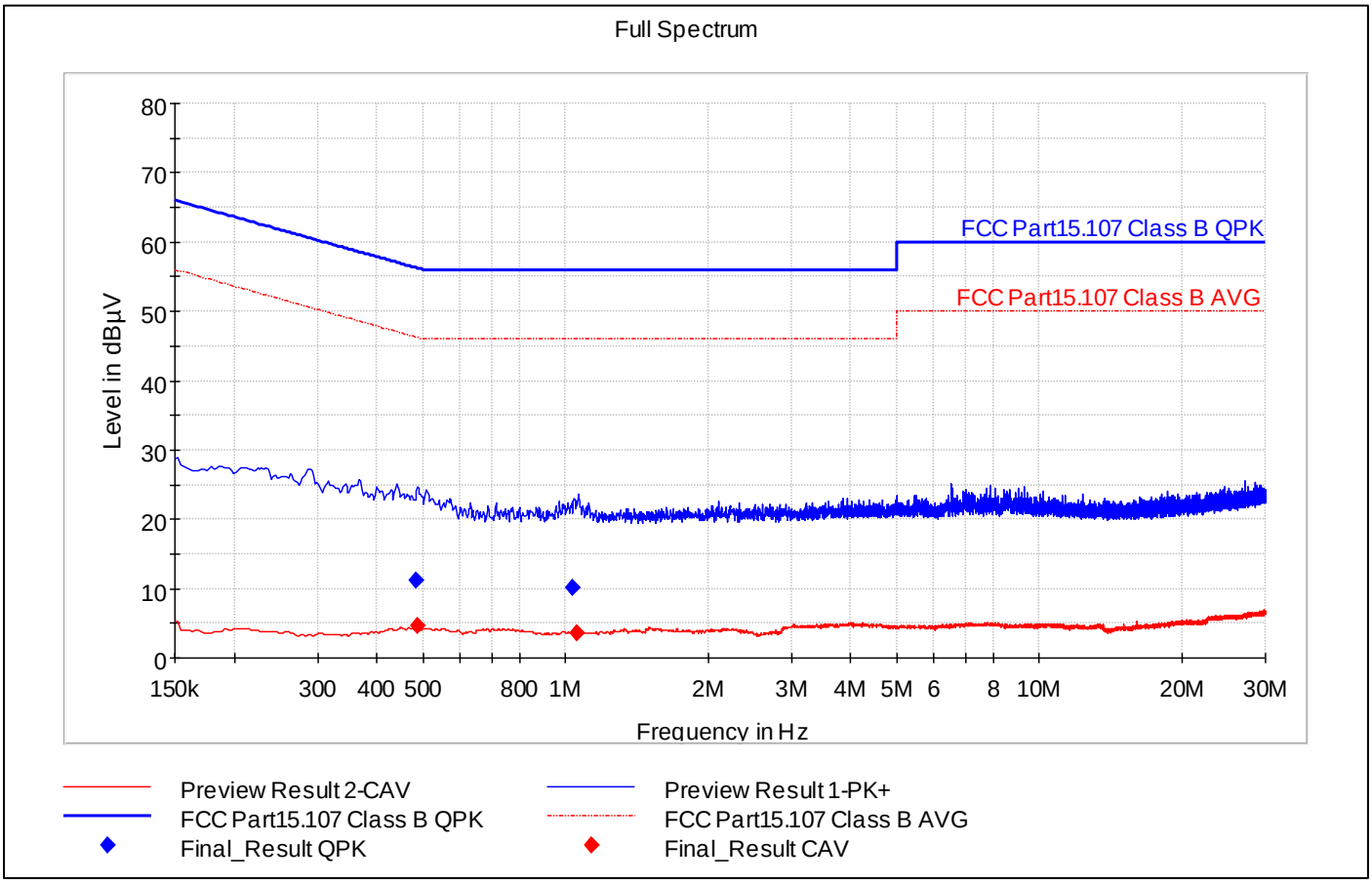
FCC part 15 subpart B & ICES-003, Graph and final result for frequency range 150kHz-30MHz, Phase



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.510000	---	6.84	46.00	39.16	15000.0	9.000	L1	ON	10.0	PASS
0.510000	17.52	---	56.00	38.48	15000.0	9.000	L1	ON	10.0	PASS
1.029750	---	4.23	46.00	41.77	15000.0	9.000	L1	ON	9.8	PASS
1.054500	14.00	---	56.00	42.00	15000.0	9.000	L1	ON	9.8	PASS

FCC part 15 subpart B & ICES-003, Graph and final result for frequency range 150kHz-30MHz, Neutral



Final_Result

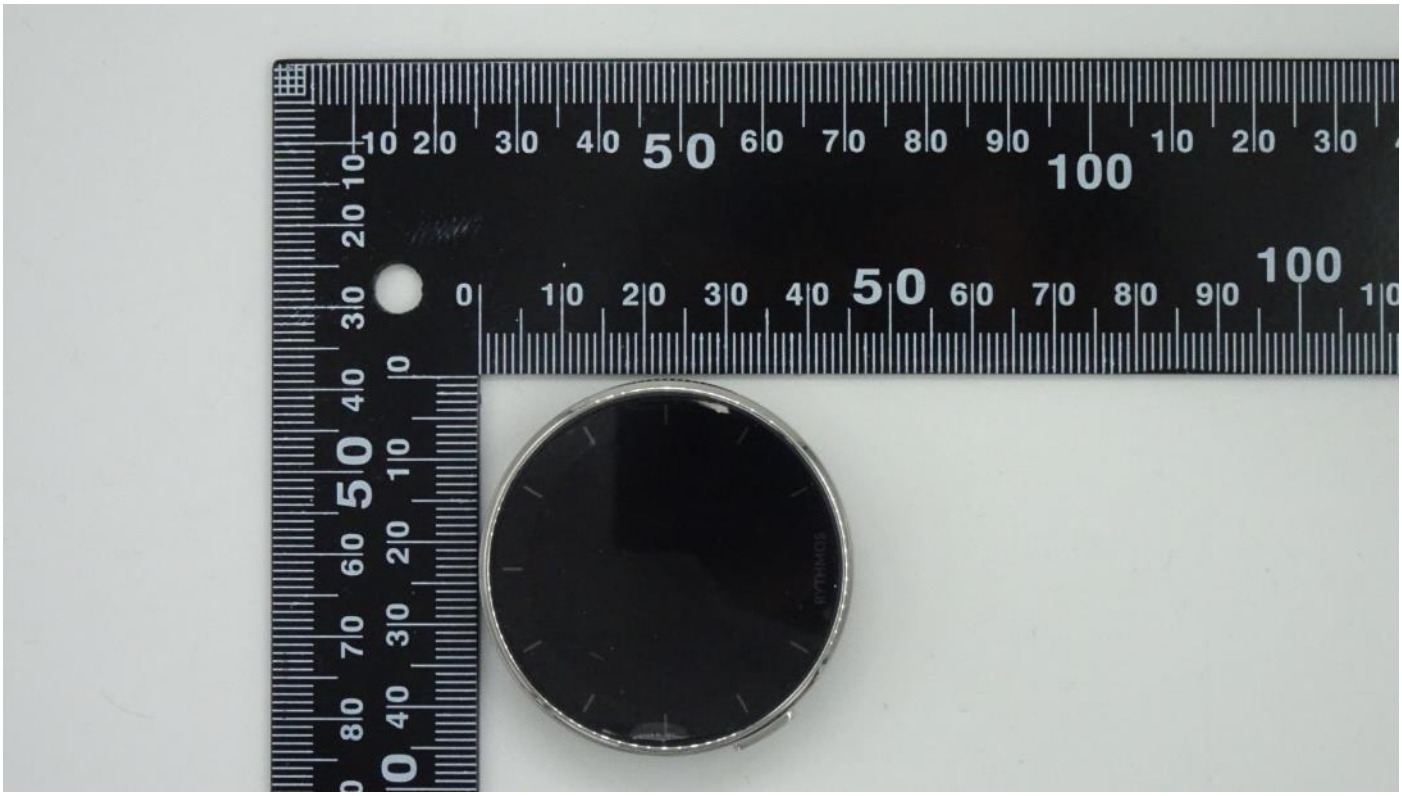
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.483000	11.25	---	56.29	45.03	15000.0	9.000	N	ON	9.9	PASS
0.487500	---	4.60	46.21	41.61	15000.0	9.000	N	ON	9.9	PASS
1.034250	10.20	---	56.00	45.80	15000.0	9.000	N	ON	9.8	PASS
1.054500	---	3.52	46.00	42.48	15000.0	9.000	N	ON	9.8	PASS

10.Test Equipment List

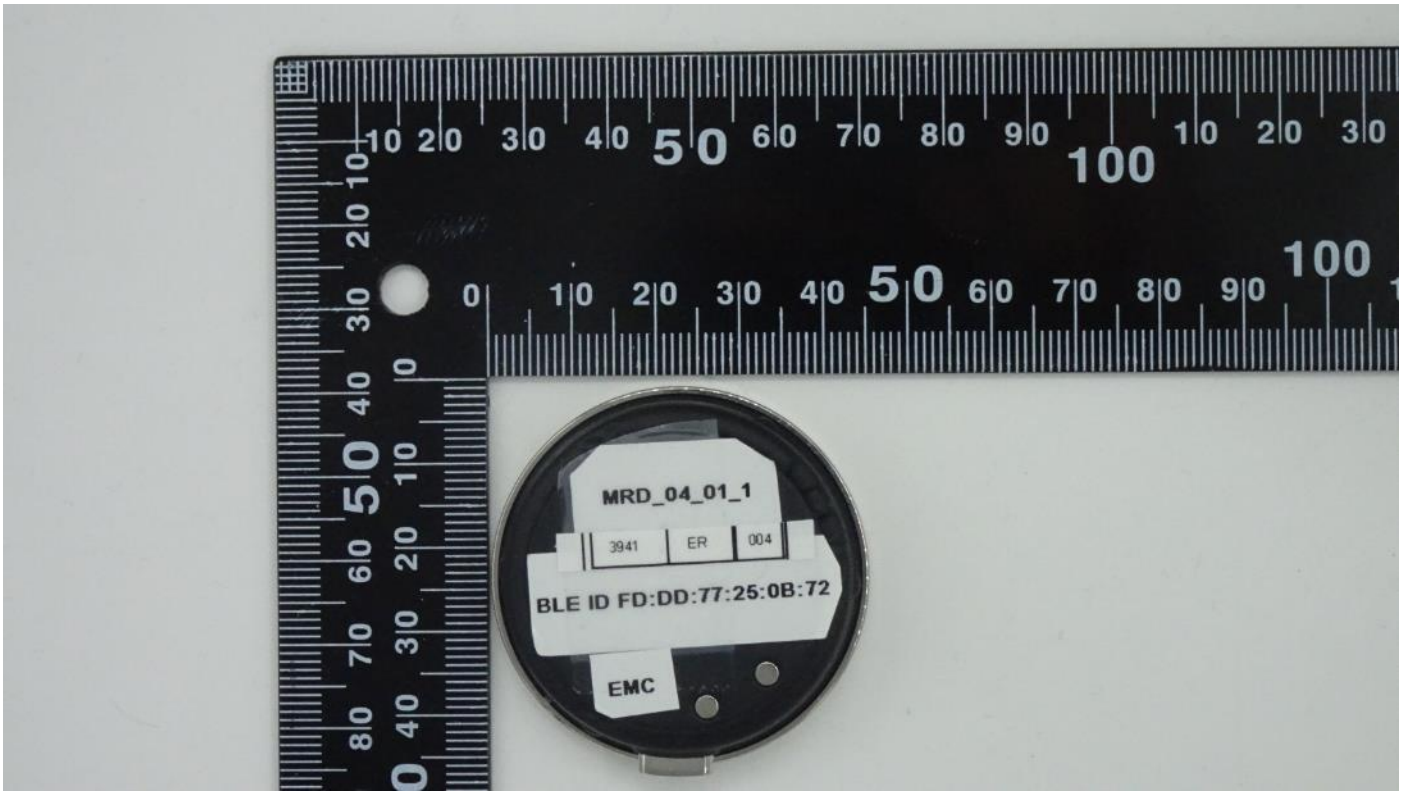
Radiated and conducted emission test equipment

New ID	Manufacturer	Equipment type	Description	Serial	Calibration information	Next calibration
G4C265	Rohde & Schwarz	ESW26	EMI test receiver	101324	6.7.2023	6.7.2024
G4C266	Rohde & Schwarz	ESH3-Z6	Single-Line V-Network, 150 A 100 kHz to 200 MHz	101516	12.9.2023	12.9.2024
G4C267	Rohde & Schwarz	ESH3-Z6	Single-Line V-Network, 150 A 100 kHz to 200 MHz	101404	12.9.2023	12.9.2024
G4C268	Rohde & Schwarz	ENY81-CA6	Coupling Networks	101657	23.8.2023	23.8.2024
G4C269	Rohde & Schwarz	ENY81	Coupling Networks	100172	23.8.2023	23.8.2024
G4C273	Frankonia	ALX-4000E	Broadband Antenna, 25MHz-4GHz with 6dB (50-A-MFN-06) att.	00816+1531	22.1.2024	22.1.2027
G4C298	Rohde & Schwarz	CMW500	Wideband radio communication tester	170980	29.6.2023	29.6.2024
G4C476	Teseq	ST08-10	Coupling/Decoupling Network	54466	11.9.2023	11.9.2024
G4C503	Rohde & Schwarz	ESIB26	EMI Test Receiver 20Hz…26.5GHz	100263	7.11.2023	7.11.2025
G4C515	Rohde & Schwarz	ENV216	Two-line V-Network LISN	101472	15.5.2023	15.5.2024
G4C516	Rohde & Schwarz	ENV216	Two-line V-Network LISN	100078	17.8.2023	17.8.2024
G4C572	Schaffner	CBL 6143	Bilog Antenna 30MHz-3GHz	5071	7.9.2022	7.9.2025
G4C576	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100163	9.8.2022	9.8.2025

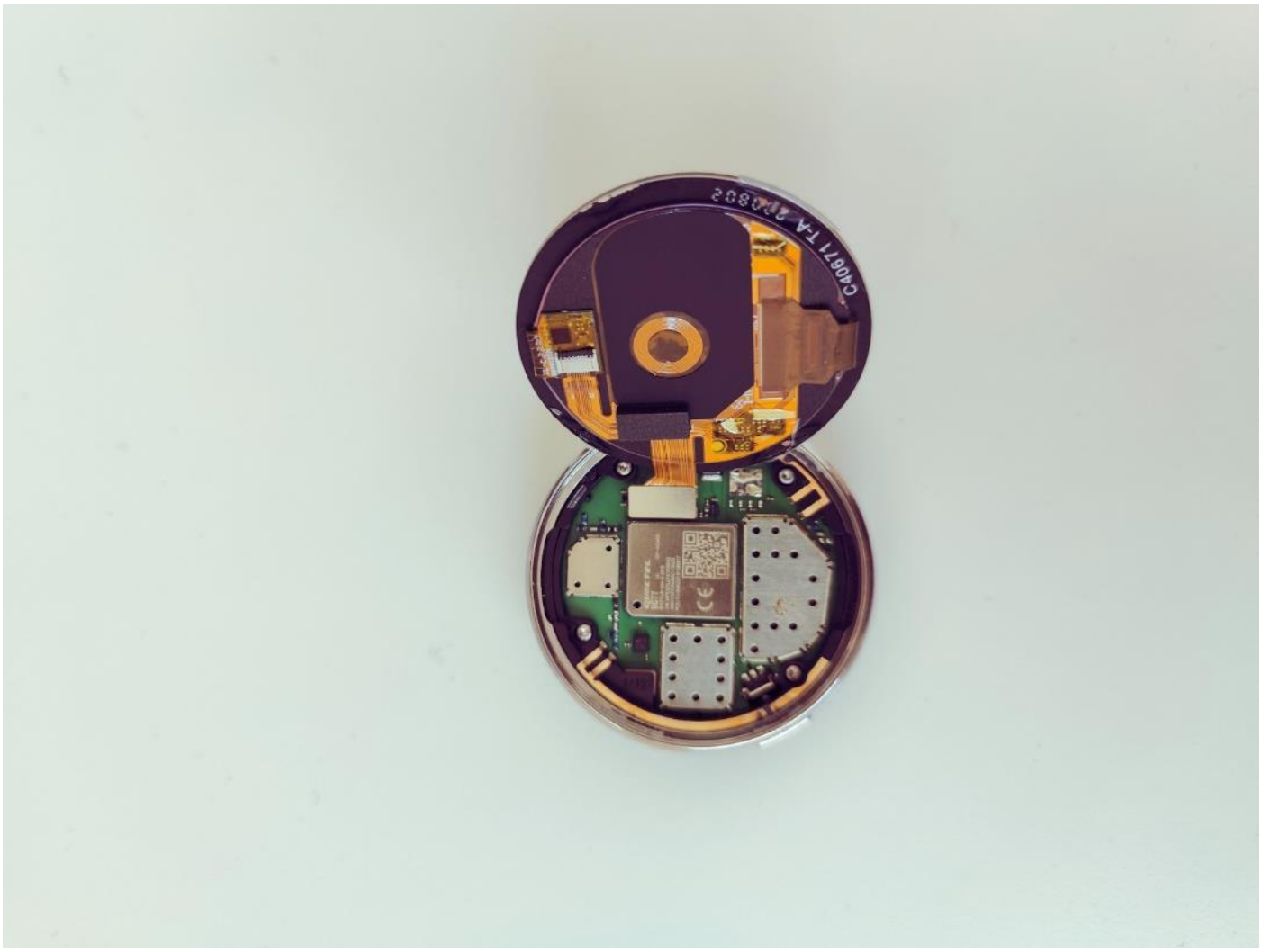
Appendix A: DUT Photographs



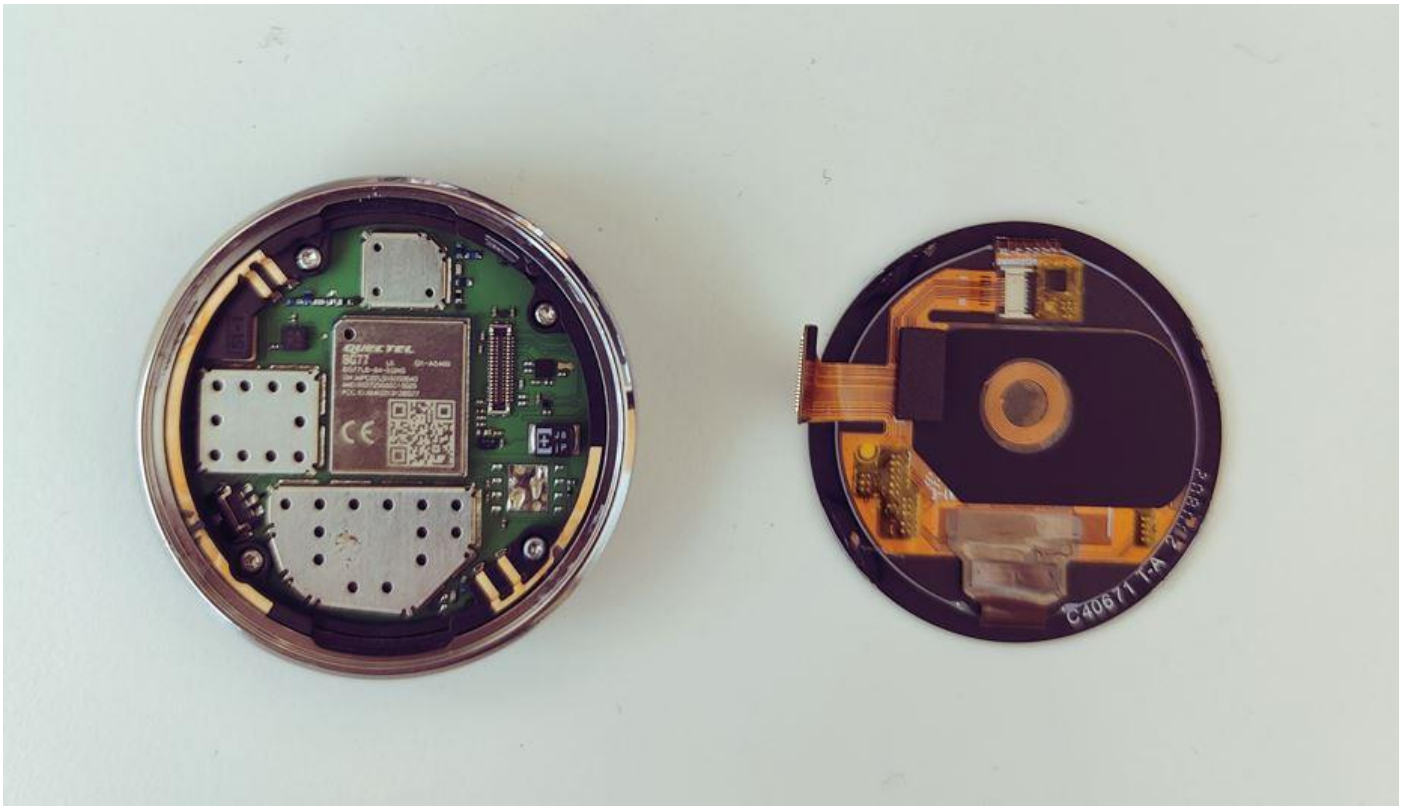
Picture 1 External pictures, EUT top view



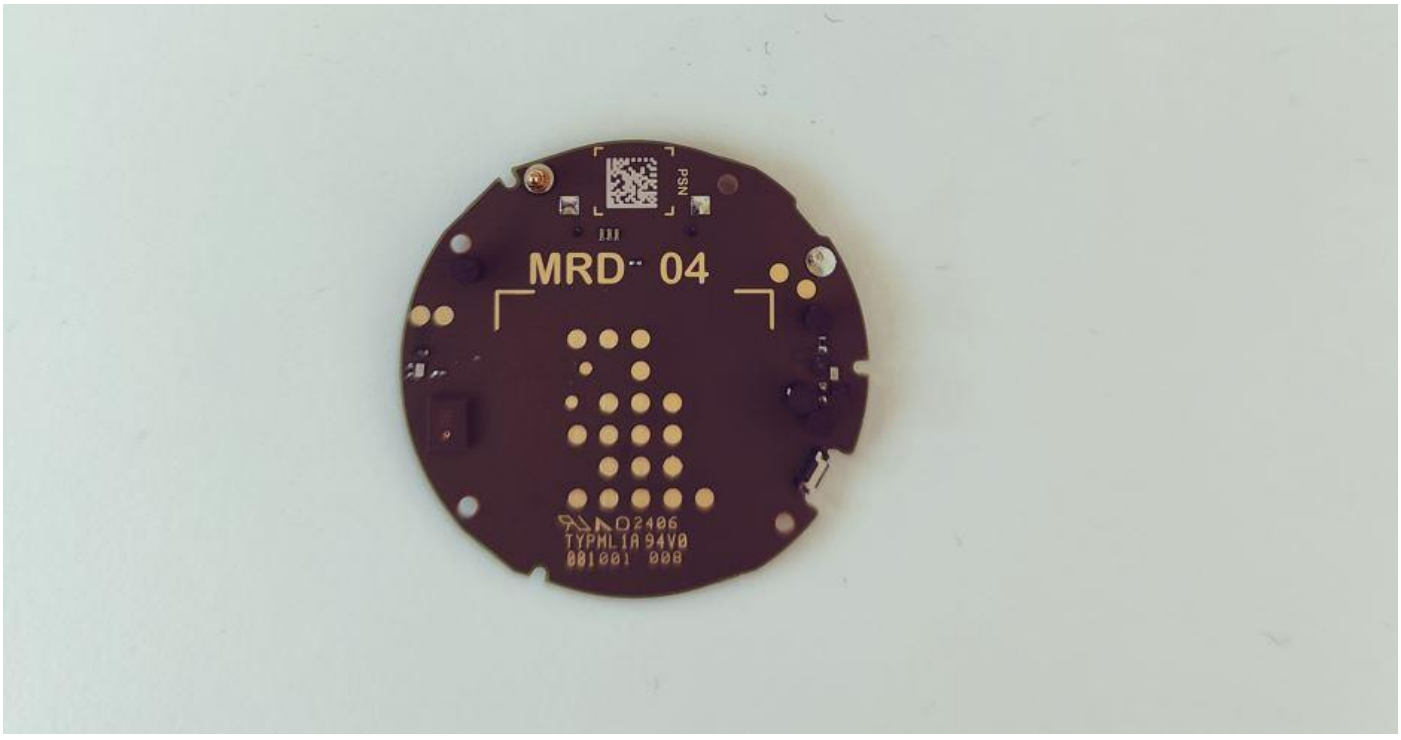
Picture 2 External pictures,EUT bottom view



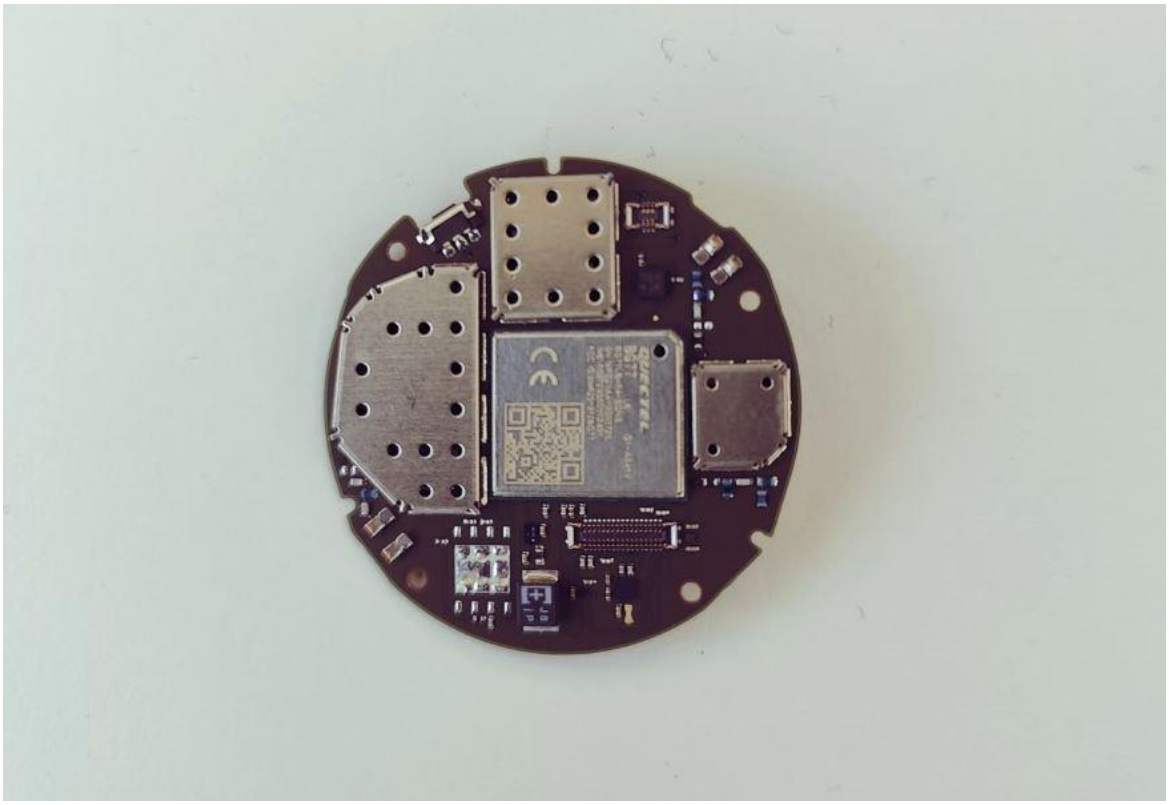
Picture 3 Internal pictures, EUT with open cover



Picture 4 Internal pictures, EUT with open cover 2



Picture 5 Internal pictures, MRD_04U bottom

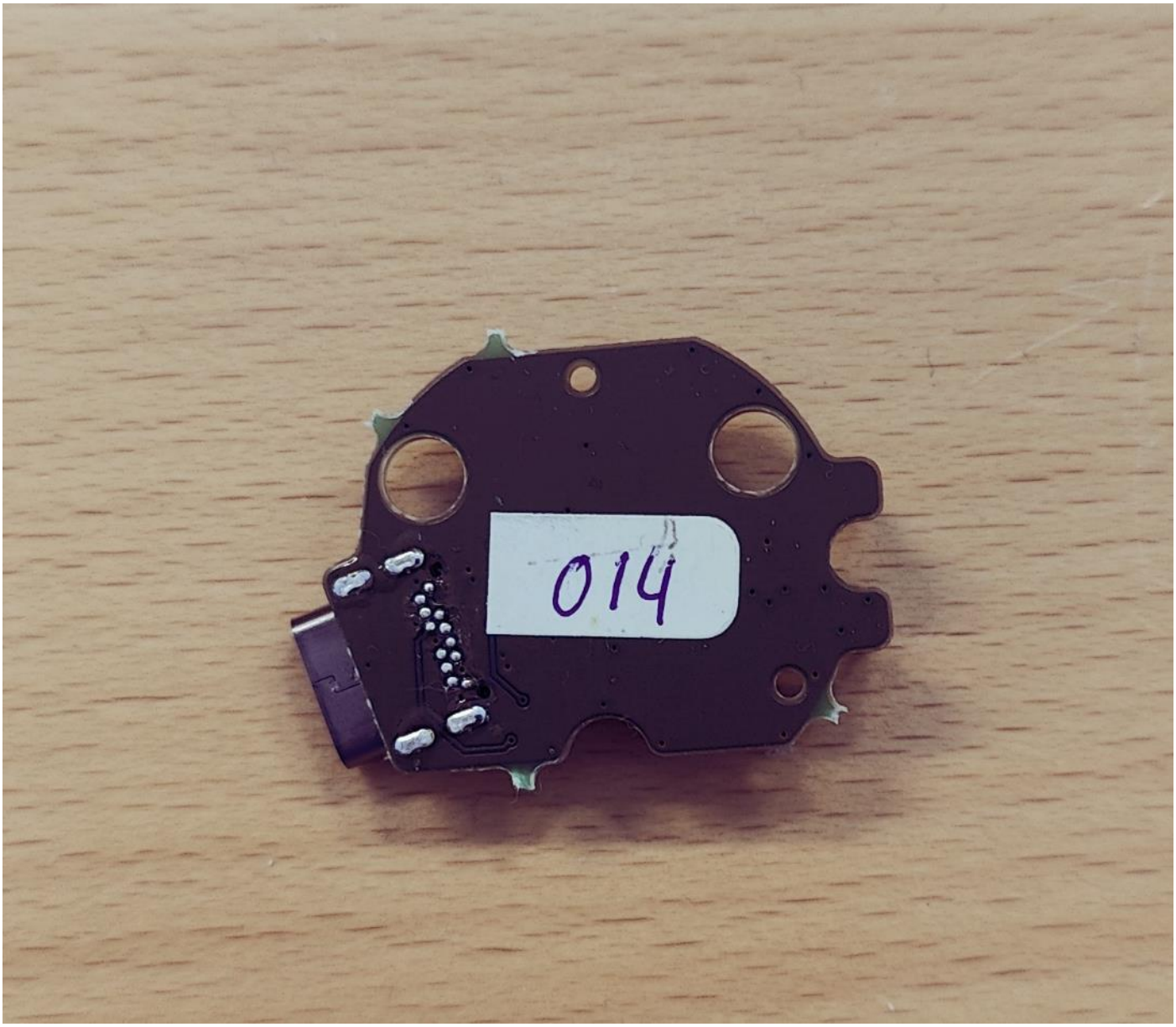


Picture 6 Internal pictures, MRD_04U top

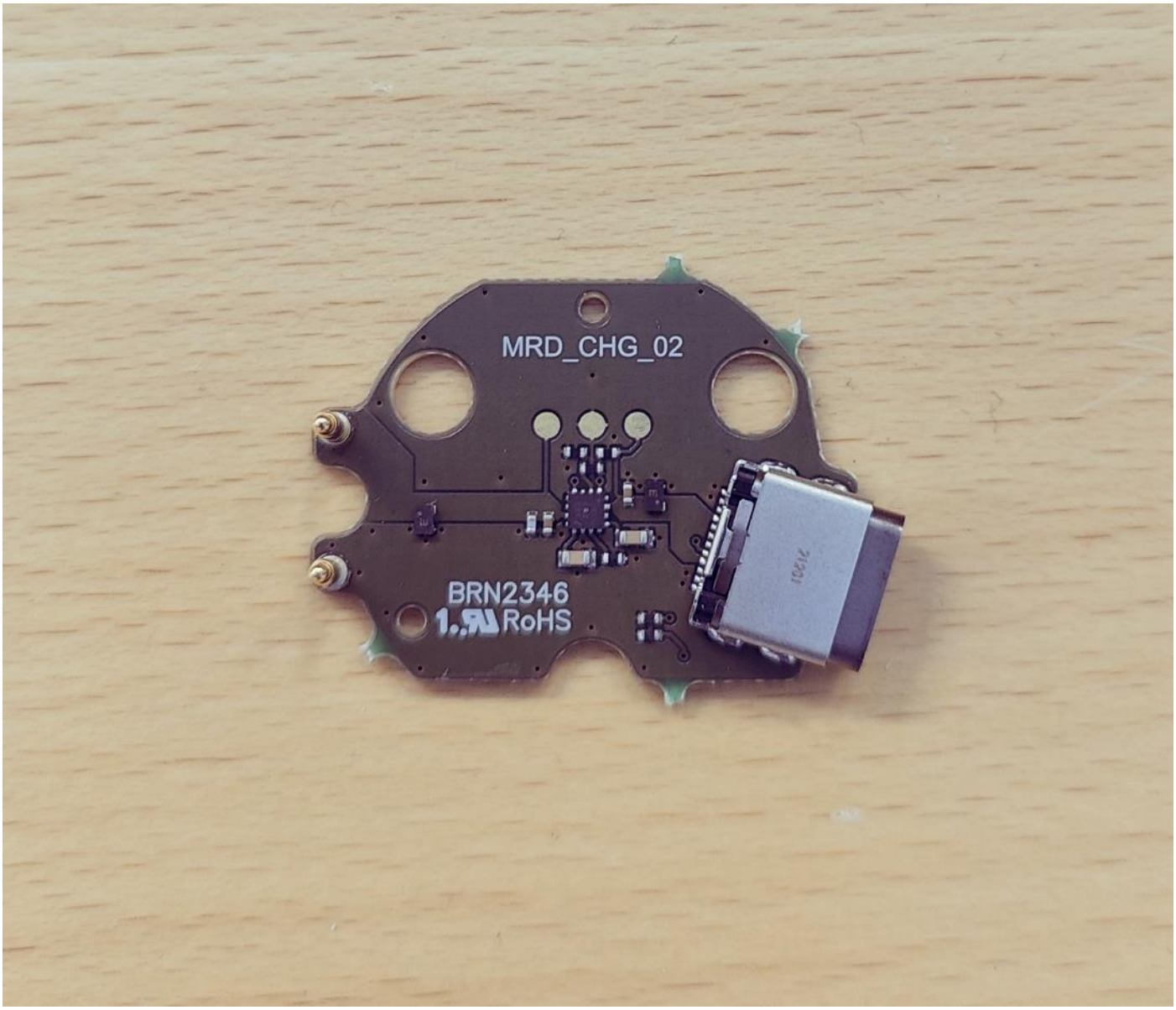
Picture 6 Internal pictures, Charger top

Picture 6 Internal pictures, Charger bottom

Picture 6 Internal pictures, Charger inside



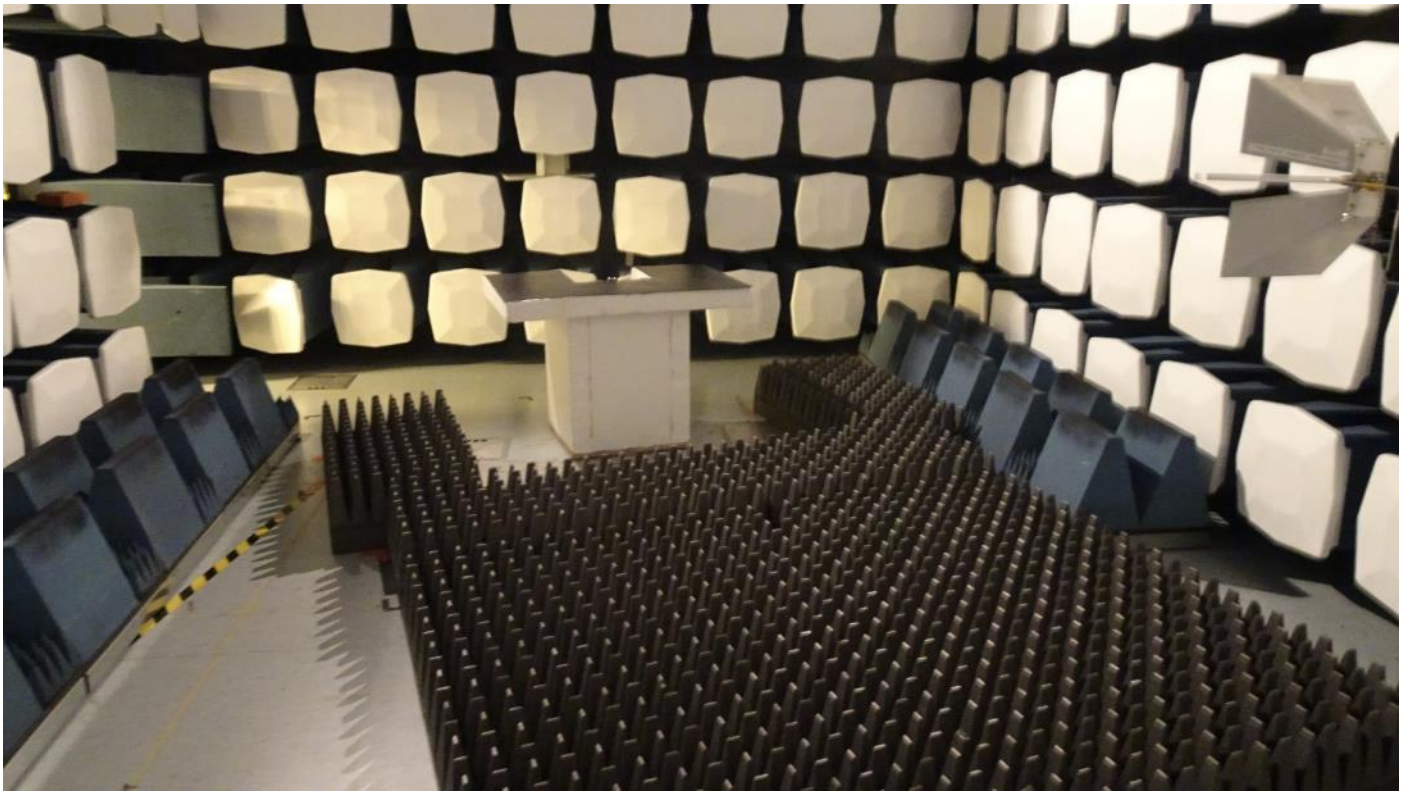
Picture 6 Internal pictures, MRD_CHG_PCB top



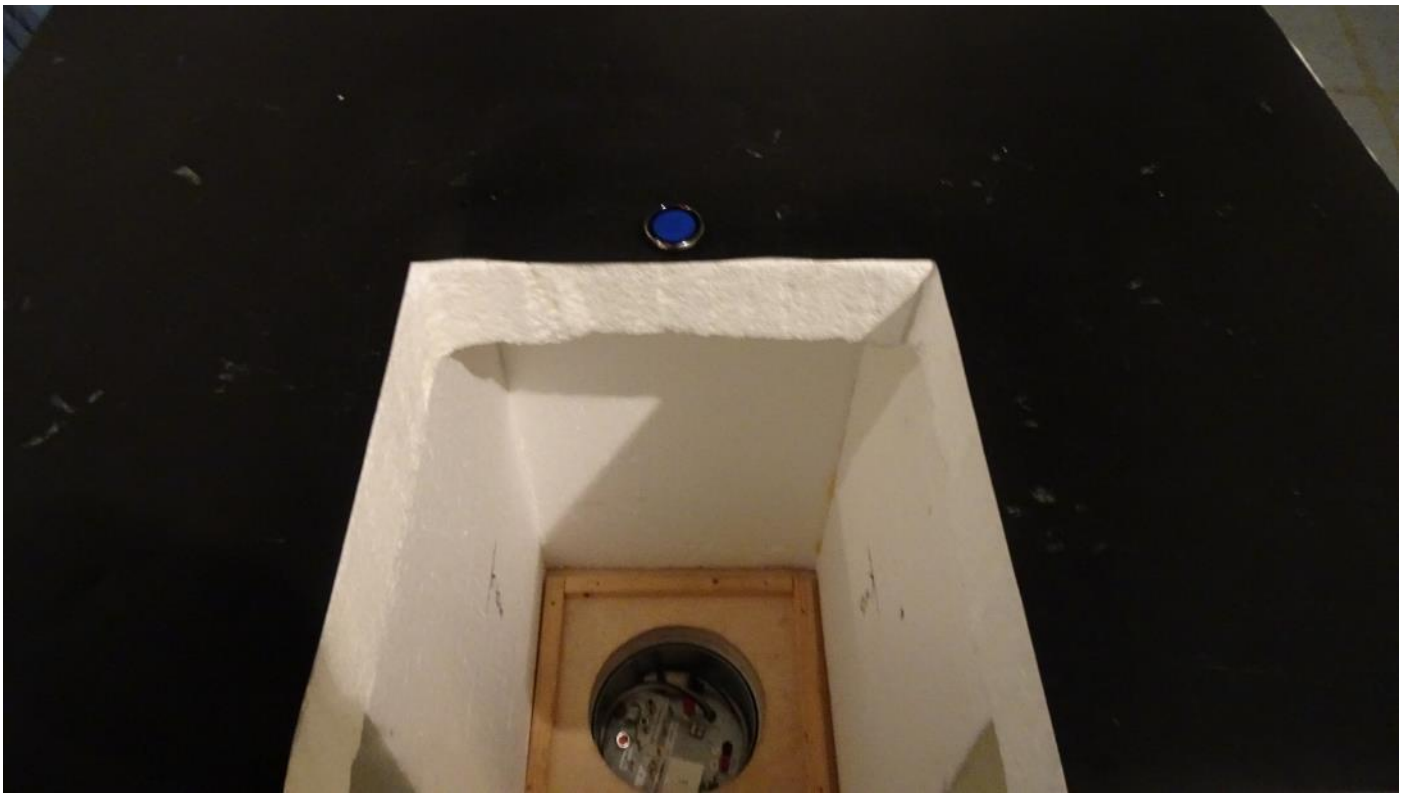
Picture 6 Internal pictures, MRD_CHG_PCB bottom

Appendix B: Test Setup Photographs

Picture 7 Radiated emission, common setup 30 -1000 MHz



Picture 8 Radiated emission, common setup, 1 – 18 GHz



Picture 9 Radiated emission pictures, EUT setup, OM1

Picture 10 Radiated emission pictures, EUT setup, OM2

Picture 11 Conducted emission