Test Report

FINAS
Finnish Accreditation Service
T004 (EN ISO/IEC 17025)

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C AND ISED CANADA REQUIREMENTS

Equipment Under Test:	Multi-Protocol Wireless Module
Model:	MGM12P22GA
Manufacturer:	Silicon Laboratories Finland Oy Bertel Jungin aukio 3 FI-02600 ESPOO FINLAND
Customer:	Silicon Laboratories Finland Oy Bertel Jungin aukio 3 FI-02600 ESPOO FINLAND
FCC Rule Part:	15.247: 2017
IC Rule Part:	RSS-247, Issue 2, 2017 RSS-GEN Issue 4, 2014
KDB:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (April 5, 2017)

Date:	31 July 2018	Date:	31 July 2018
Issued by:	Rauno Repo Testing Engineer	Checked by:	Emil Haverinen Development Engineer

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Equipment Under Test (EUT)

Trade mark:	Silicon Labs
Model:	MGM12P22GA
Type:	Multi-Protocol Wireless Module
Serial no:	-
FCC ID:	QOQMGM12P2
IC:	5123A-MGM12P2

Description of the EUT

MGM12P22G is a multi-protocol wireless module. MGM12P22GA variant is equipped with integral chip antenna.

This test report contains test results for Bluetooth Low Energy.

Classification of the device

Fixed device	☐
Mobile Device (Human body distance > 20cm)	☒
Portable Device (Human body distance < 20cm)	☒

Modifications Incorporated in the EUT

No modifications.

Ratings and declarations

Operating Frequency Range (OFR):	2402 - 2480 MHz
Channels:	40
Channel separation:	2 MHz
Modulation:	GFSK
Integral Antenna gain:	1 dBi

Power Supply

Operating voltage range: 2.0 - 3.8 VDC (tested with 3.3V regulated by the development board)

In tests the development board was supplied with laboratory power supply.

Mechanical Size of the EUT

Height: 2 mm Width: 20 mm Length: 15 mm

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	**N/T**(1
§15.247(b)(3) / RSS-247 5.4(d)	Maximum Peak Conducted Output Power	**N/T**(1
§15.247(a)(2) / RSS-247 5.2(a)	6 dB Bandwidth	**N/T**(1
§15.247(e) / RSS-247 5.2(b)	Power Spectral Density	**N/T**(1
RSS-GEN 6.6	99% Occupied Bandwidth	**N/T**(1
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	**N/T**(1
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within the Restricted Bands	**PASS**

1) Not tested by the request of the customer

EUT Test Conditions during Testing

The EUT was in continuous transmit mode during all the tests. The hopping was stopped and the EUT was configured into the wanted channel using software provided by the manufacturer.

The EUT was installed in the development board.

Following channels and settings were used during the tests:

Table 1: Test frequencies and settings

Channel	Frequency (MHz)	Power setting	PHY	Low energy transmit	Packet Length
0	2402	104	1M	PRBS9 (GFSK)	255
19	2440	104	1M	PRBS9 (GFSK)	255
39	2480	104	1M	PRBS9 (GFSK)	255

Test Facility

Testing Laboratory / address: FCC registration number: **904175**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
Test Site:	☐ Kara 10, ISED Canada registration number: **8708A-1** ☒ Kara 5, ISED Canada registration number: **8708A-2** ☐ Laru 3 ☐ Kallio 10

TEST RESULTS

Transmitter Radiated Spurious Emissions 9 kHz - 26500 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	RRE	
Date:	19 - 20 July 2018	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	
Measurement uncertainty:	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)
RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a)**.**

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables).

Peak values of emissions below 1000 MHz measured for reference as well as transmitter fundamental.

In the frequency range 9 kHz – 30 MHz measurements were performed in middle channel.

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector
30 - 80	100	40.0	Quasi-peak
88 - 216	150	43.5	Quasi-peak
216 - 960	200	46.0	Quasi-peak
960 - 1000	500	53.9	Quasi-peak
Above 1000	500	53.9	Average
Above 1000	5000	73.9	Peak

Low channel (0)

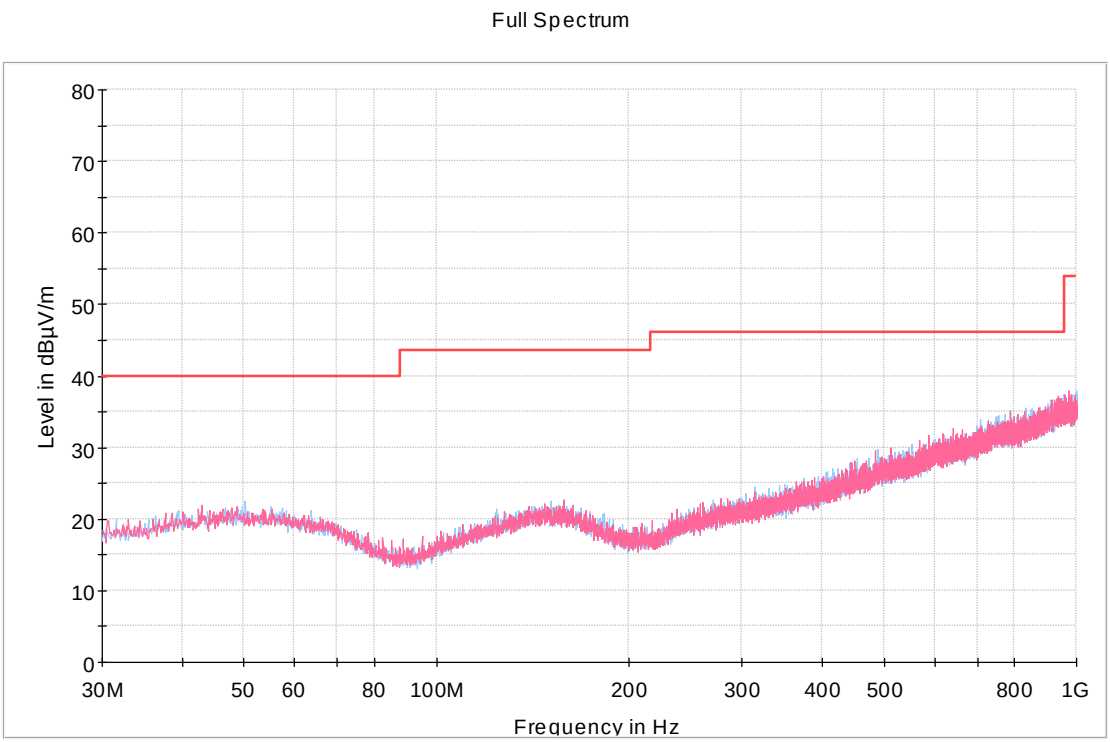

Figure 1: Channel 0 low 30 MHz – 1000 MHz

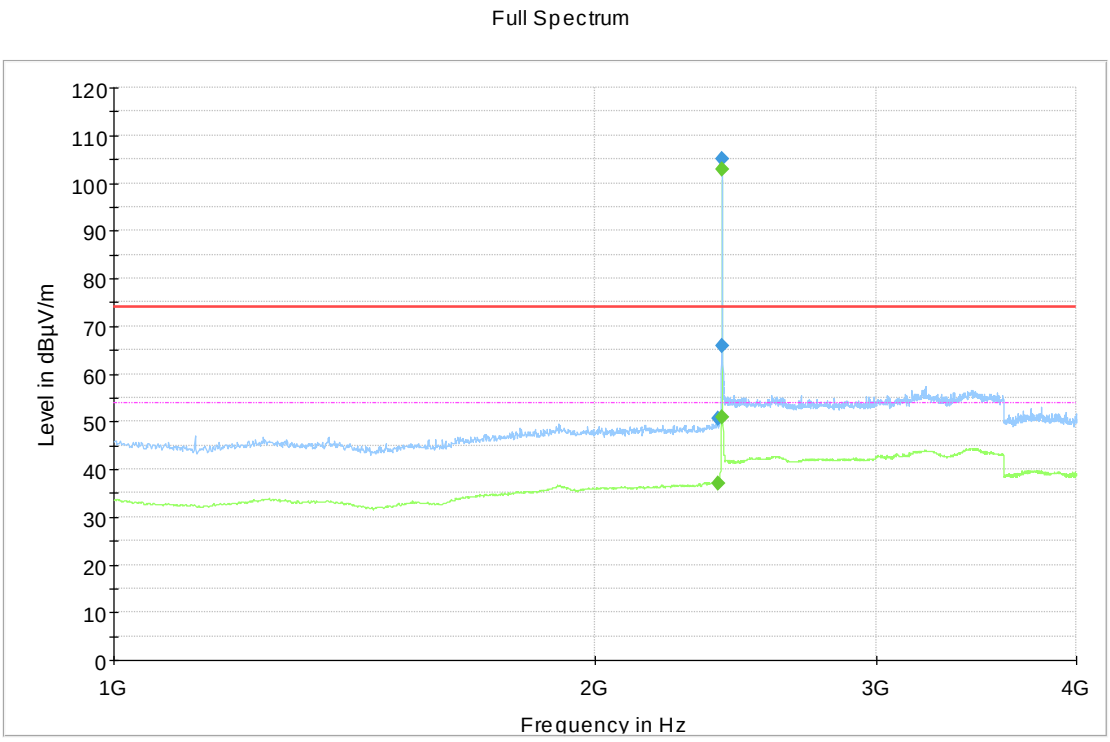

Figure 2: Channel 0 low 1 GHz – 4 GHz

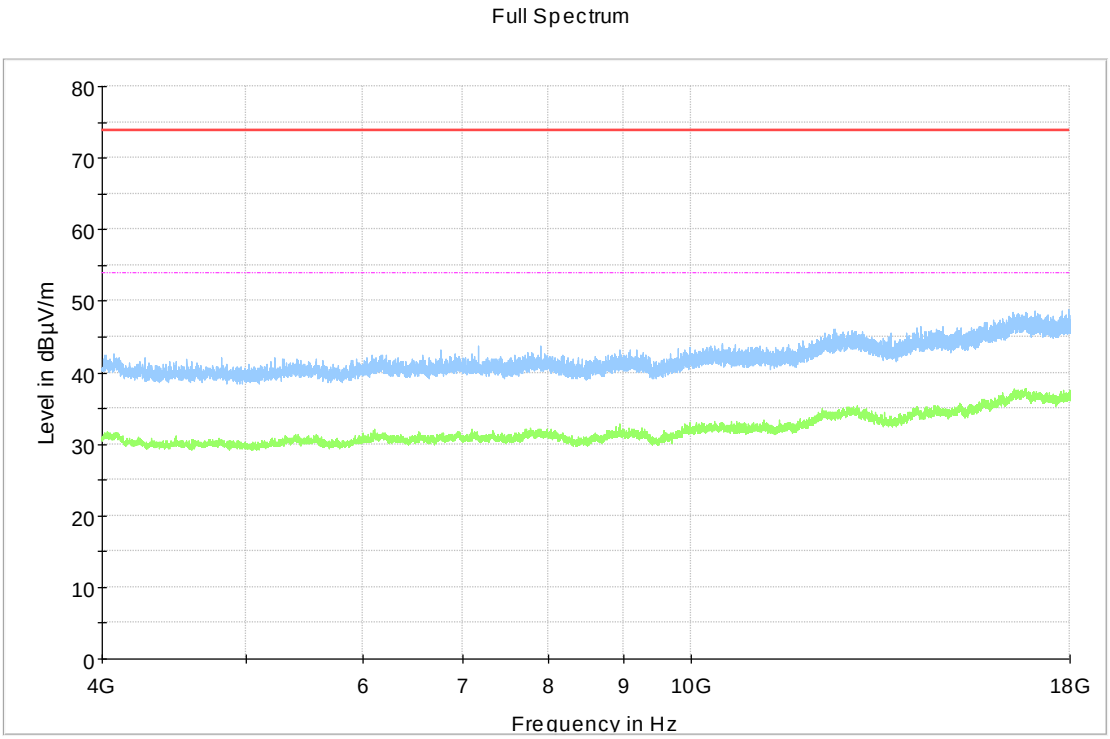

Figure 3: Channel 0 low 4 GHz – 18 GHz

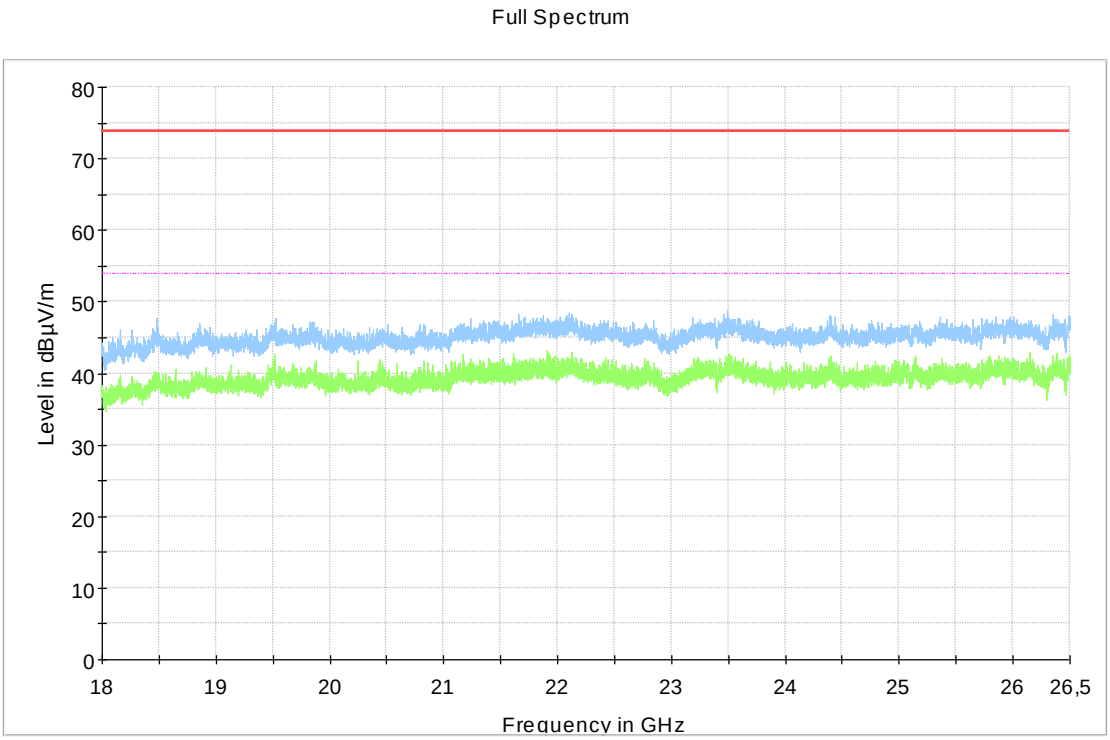

Figure 4: Channel 0 low 18 GHz – 26.5 GHz

Middle channel (19)

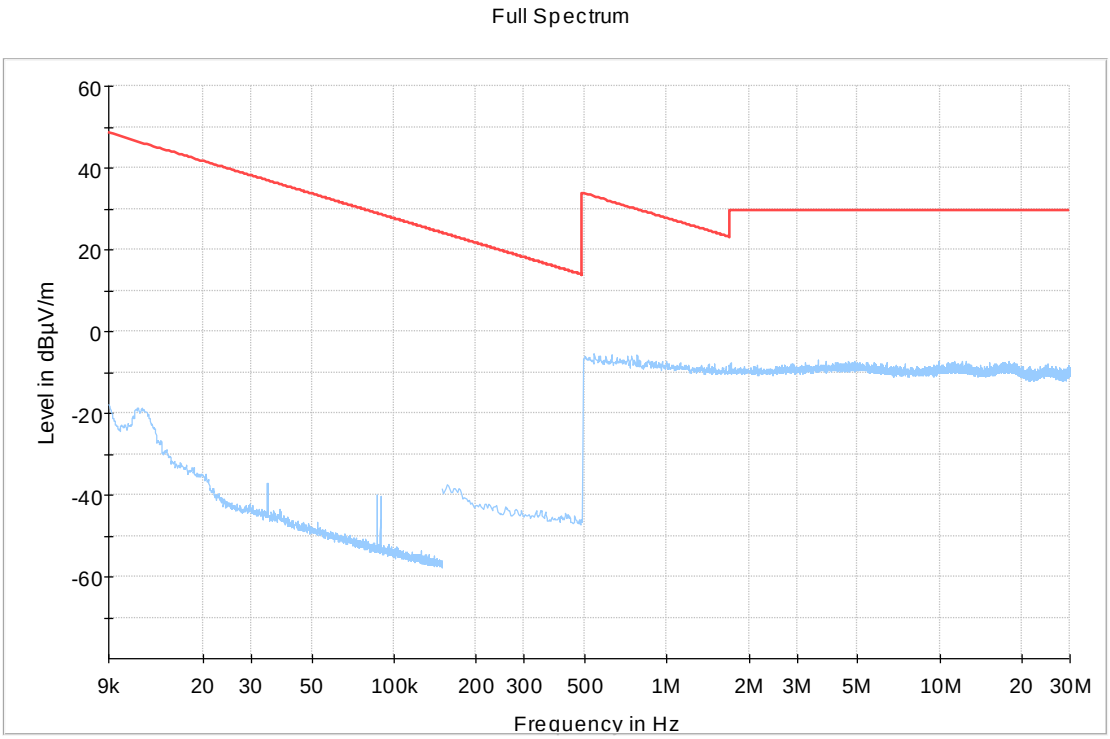

Figure 5: Channel 19 mid 9 kHz – 30 MHz

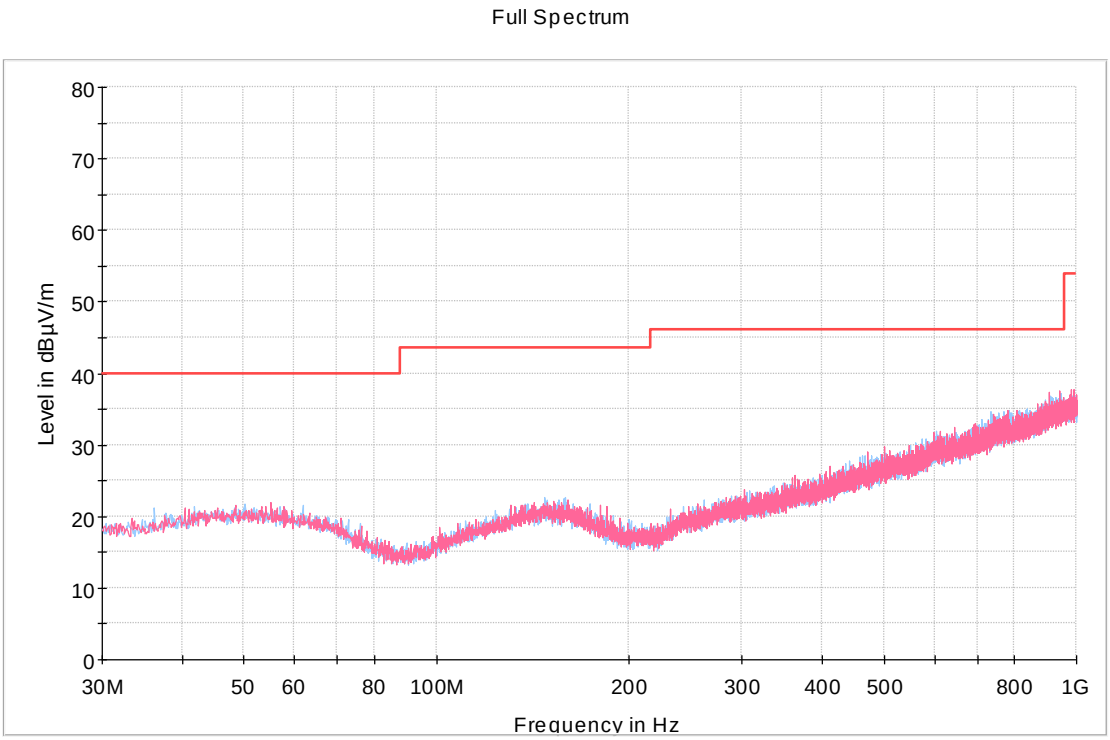

Figure 6: Channel 19 mid 30 MHz – 1000 MHz

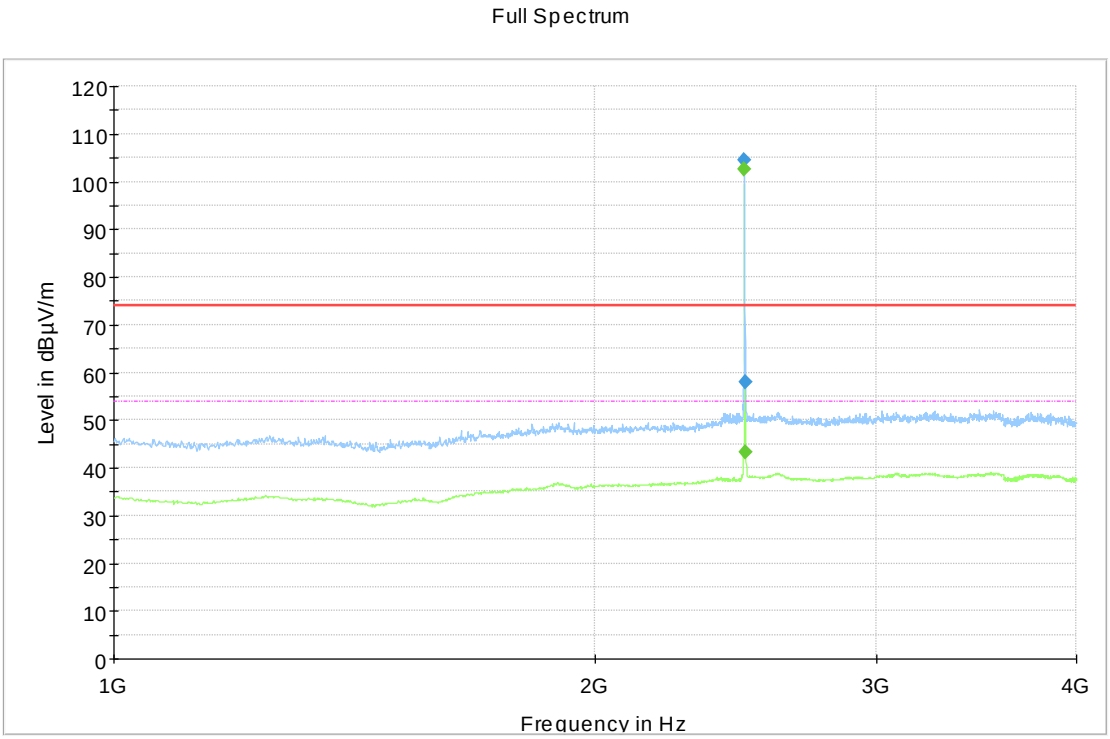

Figure 7: Channel 19 mid 1 GHz – 4 GHz

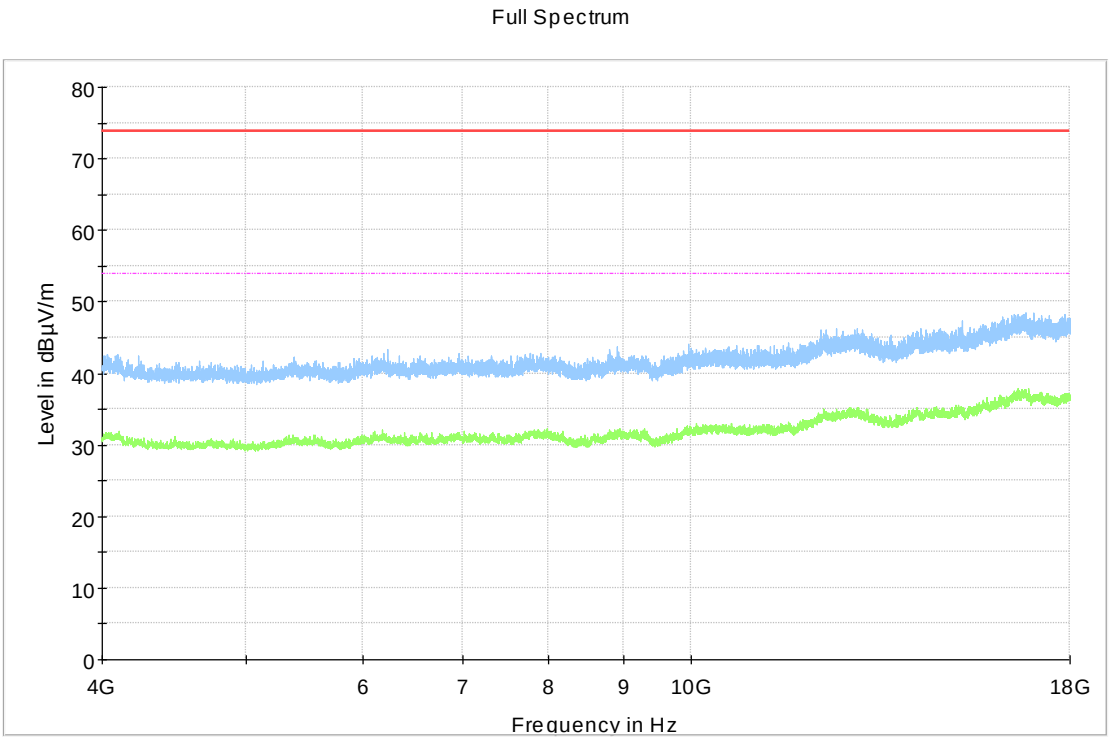

Figure 8: Channel 19 mid 4 GHz – 18 GHz

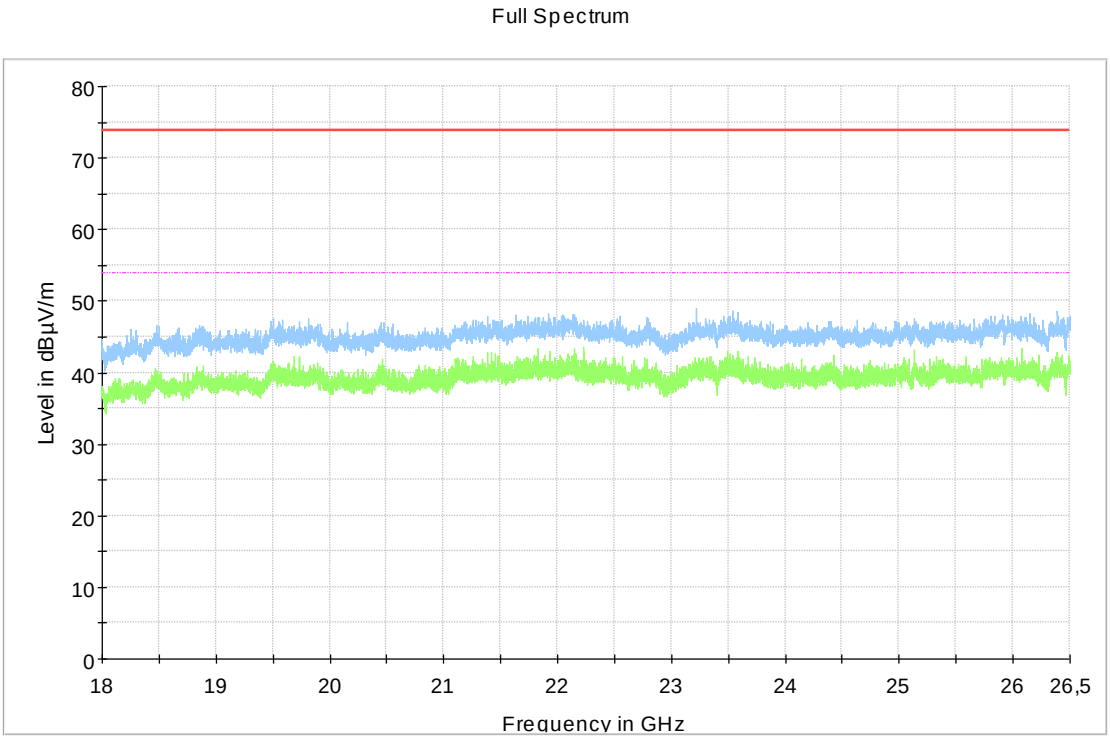

Figure 9: Channel 19 mid 18 GHz – 26.5 GHz

High channel (39)

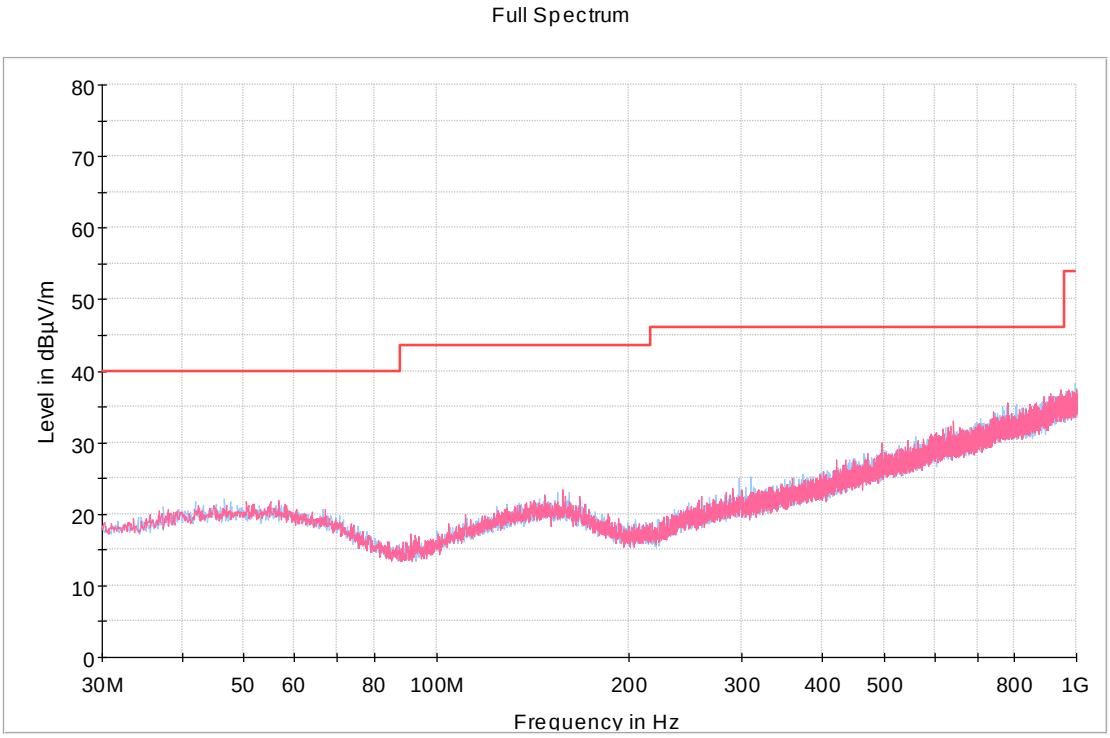

Figure 10: Channel 39 high 30 MHz – 1000 MHz

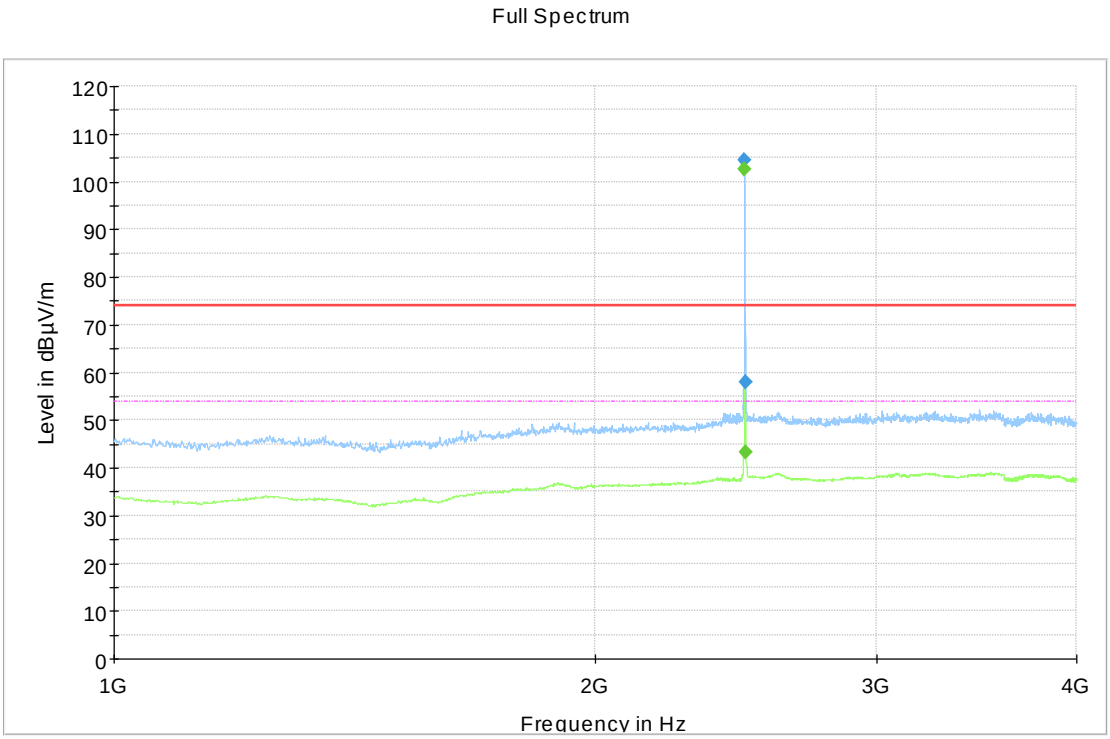

Figure 11: Channel 39 high 1 GHz – 4 GHz

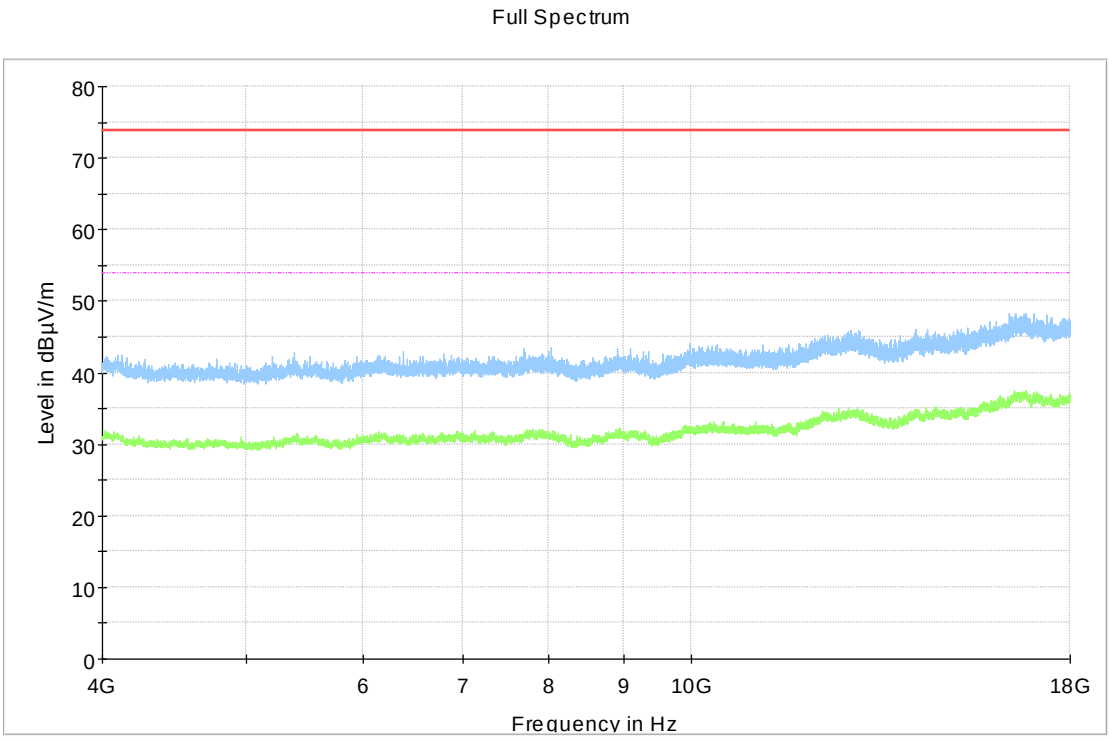

Figure 12: Channel 39 high 4 GHz – 18 GHz

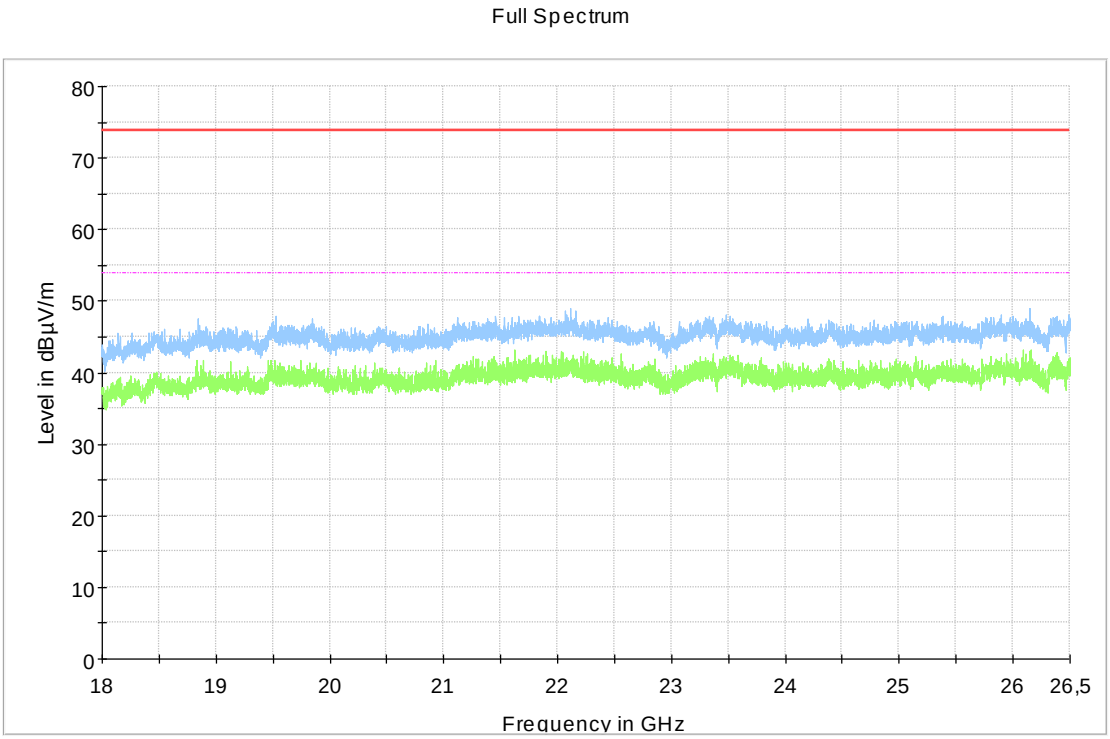

Figure 13: Channel 39 high 18 GHz – 26.5 GHz

Radiated Band Edge results

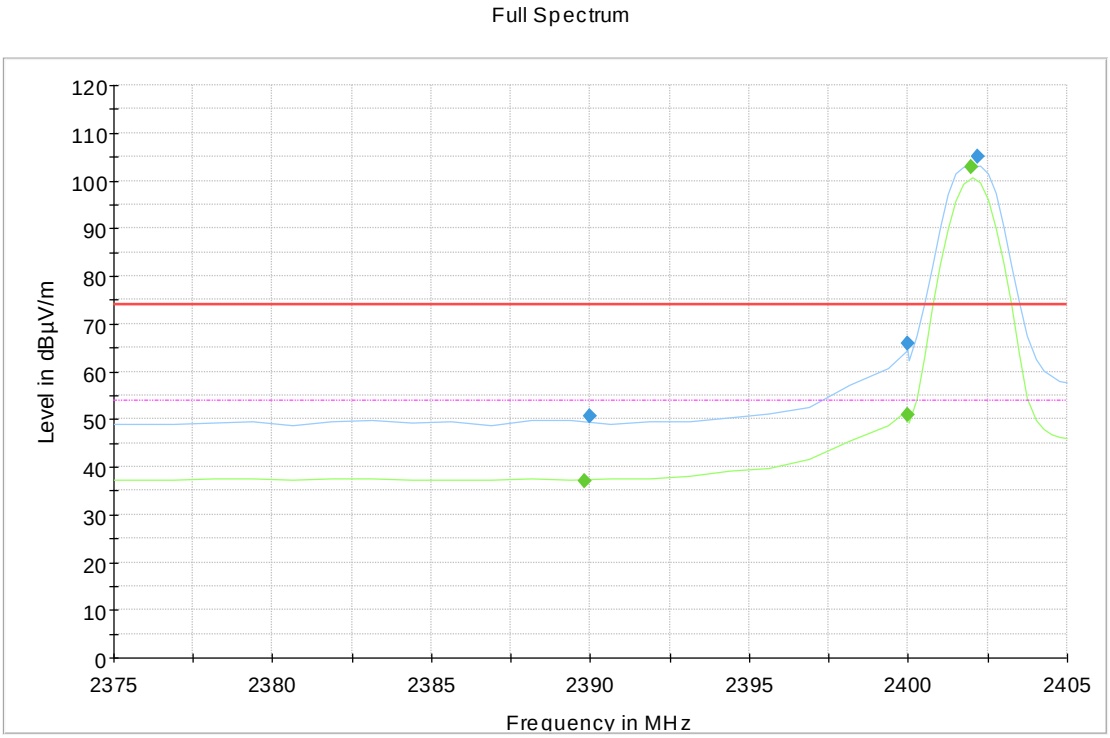

Figure 14: Radiated Band Edge measurement graph, Channel 0 low

Table 2: Peak and Average results, channel 0 low

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.800000	---	37.05	53.90	16.85	1000.0	1000.000	190.0	H	247.0	14.6
2390.000000	50.56	---	73.90	23.34	1000.0	1000.000	289.0	H	199.0	14.6
2400.000000	---	50.80	53.90	3.10	1000.0	1000.000	233.0	H	245.0	14.7
2400.000000	65.84	---	73.90	8.06	1000.0	1000.000	286.0	H	242.0	14.7

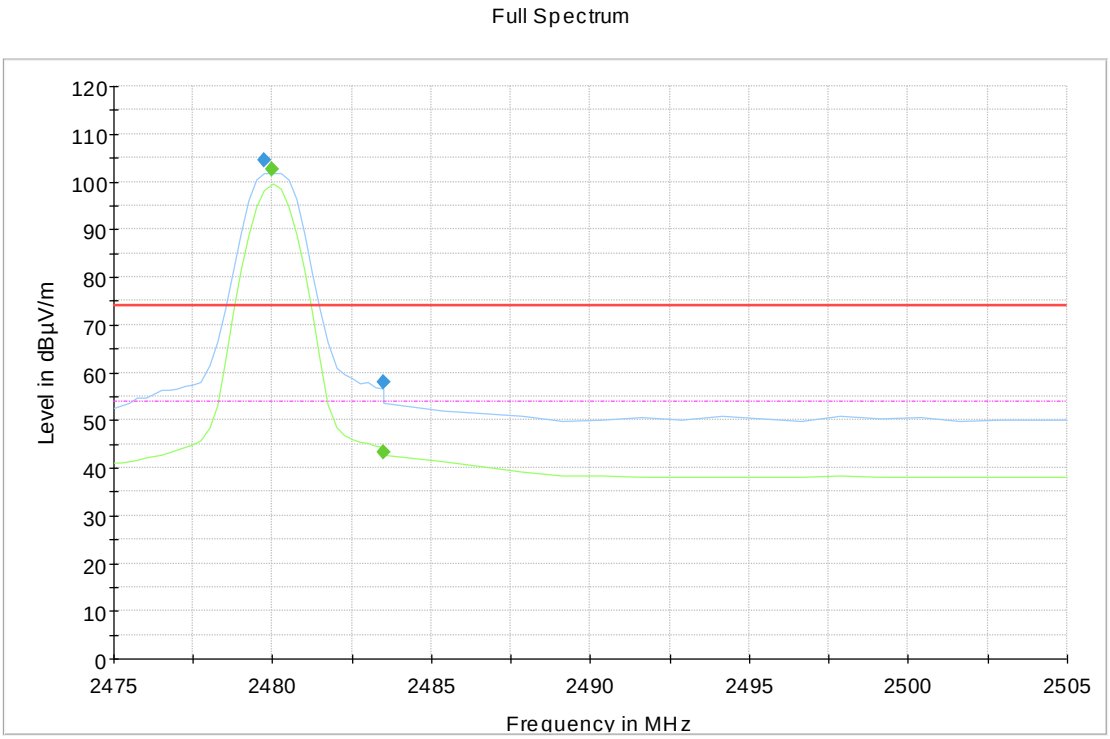

Figure 15: Radiated Band Edge measurement graph, Channel 39 high

Table 3: Peak and Average results, channel 39 high

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	43.35	53.90	10.55	1000.0	1000.000	303.0	H	232.0	14.7
2483.500000	57.84	---	73.90	16.06	1000.0	1000.000	201.0	H	196.0	14.7

TEST EQUIPMENT

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ANTENNA	A.H. SYSTEMS	SAS-200/518	inv:7873	-	-
SPECTRUM ANALYZER	AGILENT	E7405A	inv:9746	2018-01-08	2020-01-08
PREAMPLIFIER	AMC MICROWAVE	ALS1826-41-12	sn:11	2017-11-16	2018-11-16
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2017-11-16	2018-11-16
ANTENNA	EMCO	3117	inv:7293	2018-03-14	2020-03-14
ATTENUATOR	HUBER&SUHNER	6830.19.A	inv:10394	2017-11-01	2019-11-01
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
ATTENUATOR	PASTERNACK	10 dB, DC-40 GHz	sn:A1	2017-11-16	2019-11-16
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2018-06-27	2019-06-27
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2016-08-29	2018-08-29
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
POWER SUPPLY	THANDAR	TS3021S	sn:099610	-	-
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2018-04-05	2019-04-05
FILTER	WAINWRIGHT	HP, WHKX4.0/18G-10SS	inv:10403	2017-03-01	2019-03-01
MULTIMETER	BECKMAN	DM95	inv:8255	2017-12-19	2018-12-19