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:	Mobile Patient Monitor
Model:	Portrait HUB01
Manufacturer:	GE Healthcare Finland Oy Kuortaneenkatu 2 FI-00510, Helsinki Finland
Customer:	GE Healthcare Finland Oy Kuortaneenkatu 2 FI-00510, Helsinki Finland
FCC Rule Part:	15.247
IC Rule Part:	RSS-247, Issue 2, 2017 RSS-GEN Issue 5 Amendment 2, 2021
KDB:	558074 D01 15.247 Meas Guidance v05r02 Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under §15.247 of the FCC rules (April 2, 2019)

Date:	1 September 2021	Date:	3 September 2021
Issued by:	Mikko Halonen Development Engineer	Checked by:	Rauno Repo Senior EMC Specialist

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GENERAL REMARKS

Disclaimer

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	1 September 2021

PRODUCT DESCRIPTION

Equipment Under Test

Trade mark:	GE
Model:	Portrait HUB01
Type:	Mobile Patient Monitor
Serial no:	Sample 1: SRW20440005SP (RF_HUB_RFV_1) Sample 2: SRW20440013SP (RF_HUB_RFV_C1)
FCC ID:	2AO8L-HUB01
IC:	25821-HUB01

General Description

The Portrait HUB01 (later Hub) is a part of GE Healthcare's Portrait Mobile Monitoring Solution system. The Hub enables continuous monitoring of patients by acquiring signals from body-worn sensors through the GE proprietary Medical Body Area Network (MBAN) radio as well as displaying trends and events. The Hub further delivers the patient data to a hospital network through the WLAN (802.11a/b/g/n) radio. Pairing between a Hub and a sensor is made by using an NFC (ISO/IEC 14443) reader in the Hub. In addition to the active MBAN, WLAN and NFC radios, the Hub has a passive RFID tag (EPCglobal Gen-2) that is used for asset management. All Hub antennas are integrated in the mechanics. Besides the wireless interfaces the hub incorporates a 5-pin GE proprietary USB connector in the back of the Hub. The USB connector is used for charging the Hub battery and it enables the SW updates and device configuration.

Classification

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

Modifications Incorporated in the EUT

In both samples the PWB RF is reworked to be mass production equivalent.

In conducted sample the RF test cables were plugged into existing production test connectors. The production test connectors locate on the PWB next to antenna inputs.

Ratings and declarations

Operating Frequency Range (OFR):	2412.0 – 2462.0 MHz
Channels:	11
Channel separation:	5 MHz
Transmission technique:	DSSS
Nominal Channel Bandwidth:	20 MHz
Antenna type:	Integrated custom monopole antennas
Integral Antenna gain:	6 dBi (highest gain in the frequency range)

Power Supply

Operating voltage range:	3.6 VDC (nominal battery voltage)

Mechanical Size of the EUT

Height: 21 mm	Width: 63 mm	Length: 141 mm

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.203	Antenna requirement	N/T(1
§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 Conducted Output Power	PASS
§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	PASS
RSS-GEN 6.7	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

The decision rule applied for the tests results stated in this test report is according to the requirements of section 1.3 of ANSI C63.10-2013.

EUT Test Conditions during Testing

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

All measurements were performed with the transmit power set to the maximum level the equipment hardware is capable of.

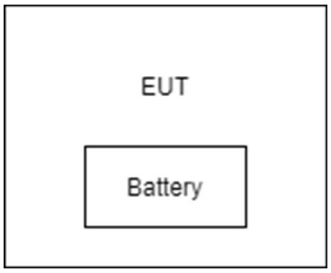

Figure 1: Test setup blocking diagram

Table 1: Test frequencies and settings

Channel	Frequency (MHz)
1	2412
6	2437
11	2462

Test Facility

Testing Laboratory / address: FCC designation number: **FI0002** ISED CAB identifier: **T004**	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	☐ K10LAB, ISED Canada registration number: **8708A-1** ☒ K5LAB, ISED Canada registration number: **8708A-2** ☐ T10LAB

TEST RESULTS

Maximum Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	MIH	
Date:	27 August 2021	
Temperature:	23.1 ºC	
Humidity:	47.9 %RH	
Measurement uncertainty:	± 2.87dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)
RSS-247 5.4(d)

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 1 Watt. As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Gated RMS power was measured with Rohde & Schwarz TS8997 test system. Following measurement method was used, AVGPM-G (C11.9.2.3.2), ANSI 63.10

Results:

Table 2: Maximum conducted output power

802.11b, 1 Mbps

Data rate [Mbps]	Conducted power, Gated RMS [dBm]			Limit [dBm]	Result
	Low channel 1	Mid channel 6	High channel 11		
1	10.4	10.4	10.5	30	PASS

802.11g, 6 Mbps

Data rate [Mbps]	Conducted power, Gated RMS [dBm]			Limit [dBm]	Result
	Low channel 1	Mid channel 6	High channel 11		
6	6.5	11.0	6.5	30	PASS

802.11n, 6.5 Mbps

Data rate [Mbps]	Conducted power, Gated RMS [dBm]			Limit [dBm]	Result
	Low channel 1	Mid channel 6	High channel 11		
6.5	6.6	10.3	6.7	30	PASS

Transmitter Radiated Spurious Emissions 9 kHz – 26.5 GHz

Standard:	ANSI C63.10	(2013)
Tested by:	HEE/PKA	
Date:	27 August 2021	
Temperature:	23.1 ºC	
Humidity:	47.9 %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.

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector
0.009-0.490	2400/F(kHz)	48.5-13.8	Quasi-peak
0.490-1.705	24000/F(kHz)	33.8-22.97	Quasi-peak
1.705-30.0	30	29.54	Quasi-peak
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

The pre-measurements were performed with the EUT being in three orthogonal positions (X, Y, Z). Final measurements were done in worst position.

The emission results below 1000 MHz are reported one channel only, because the emissions do not depend on the operating channel.

Results LOW channel

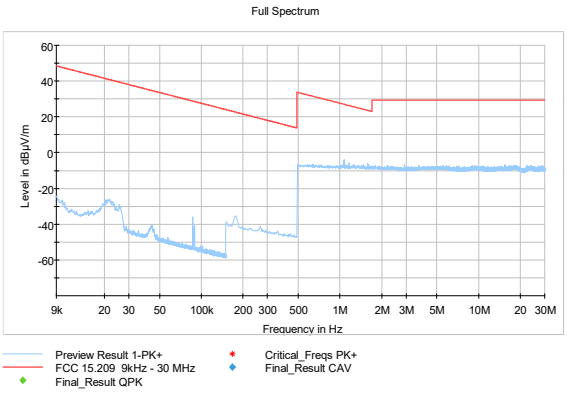

Figure 2: LOW channel b mode (9 kHz – 30 MHz)

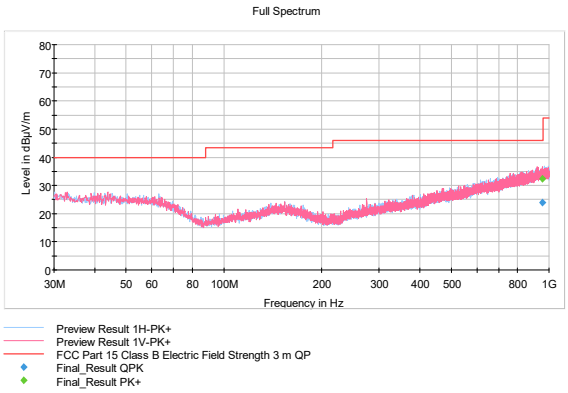

Figure 3: LOW channel b mode (30 MHz – 1000 MHz)

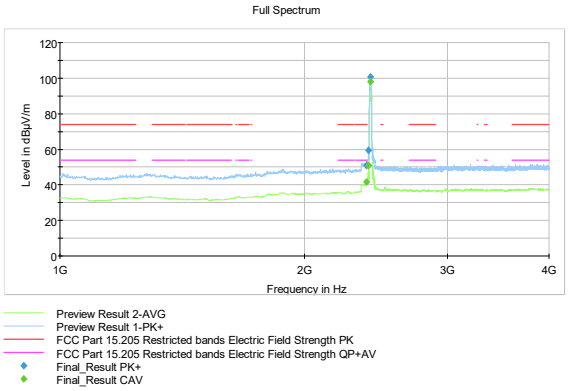

Figure 4: LOW channel b mode (1 GHz – 4 GHz)

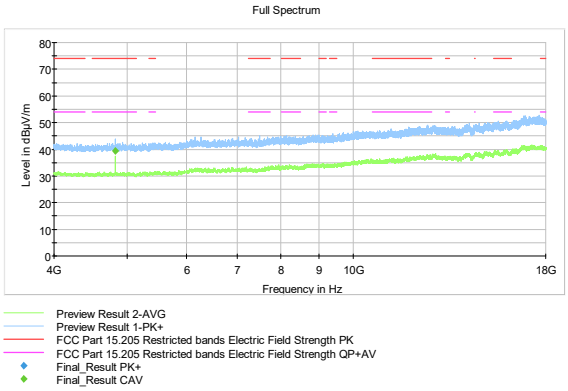

Figure 5: LOW channel b mode (4 GHz – 18 GHz)

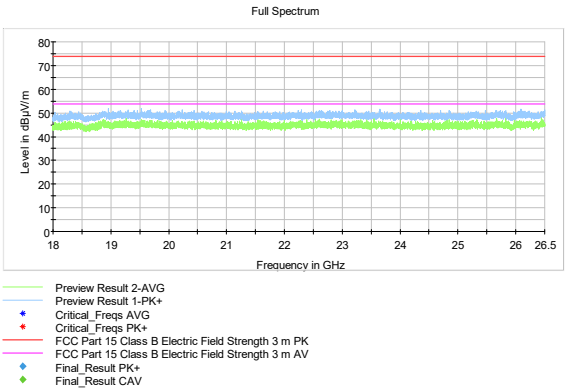

Figure 6: LOW channel b mode (18 GHz –26.5 GHz)

Table 3: Peak results LOW channel

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
952.892000	32.34	46.00	13.66	1000.0	120.000	109.0	V	240.0
2385.400000	41.61	54.00	12.39	1000.0	1000.000	202.0	V	82.0
2396.800000	50.98	---	---	1000.0	1000.000	121.0	V	244.0
2411.250000	98.17	---	---	1000.0	1000.000	157.0	V	61.0

Table 4: Average results LOW channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4823.900000	39.45	54.00	14.55	1000.0	1000.000	205.0	H	150.0

Table 5: Quasi-peak results LOW channel

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
952.892000	24.04	46.00	21.96	1000.0	120.000	109.0	V	240.0

Results MID channel

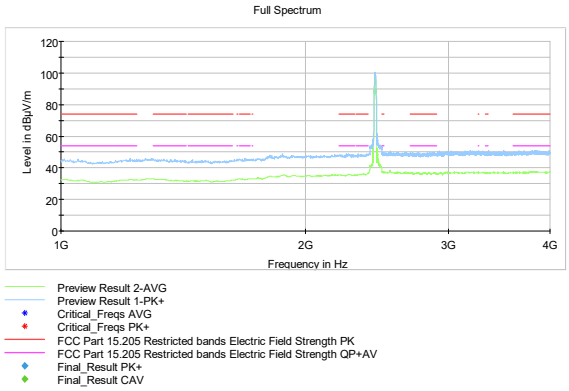

Figure 7: MID channel b mode (1 GHz – 4 GHz)

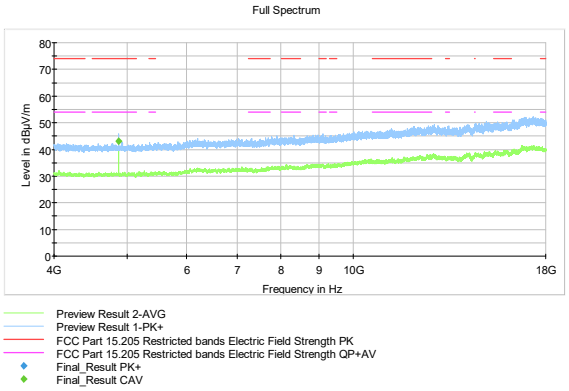

Figure 8: MID channel b mode (4 GHz – 18 GHz)

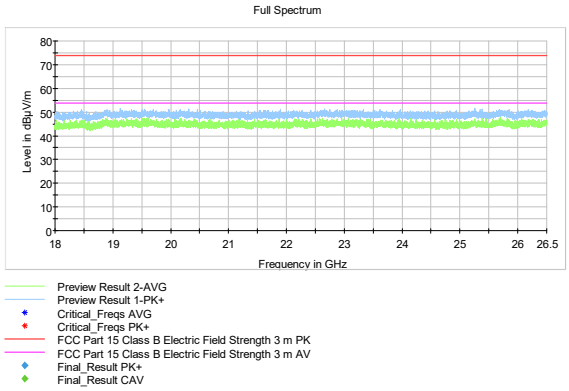

Figure 9: MID channel b mode (18 GHz – 26.5 GHz)

Table 6: Average results MID channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4874.000000	43.01	54.00	10.99	1000.0	1000.000	131.0	V	2.0	7.5

Results HIGH channel

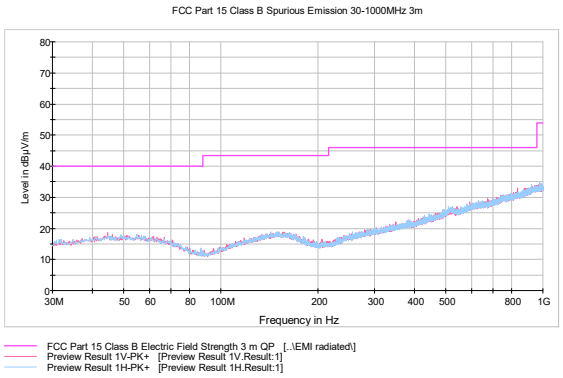

Figure 10: HIGH channel b mode (30 MHz – 1000 MHz)

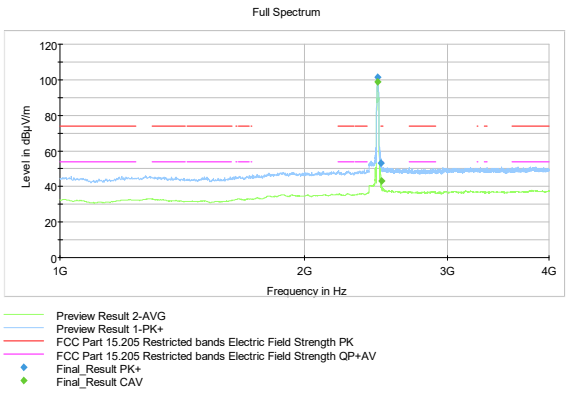

Figure 11: HIGH channel b mode (1 GHz – 4 GHz)

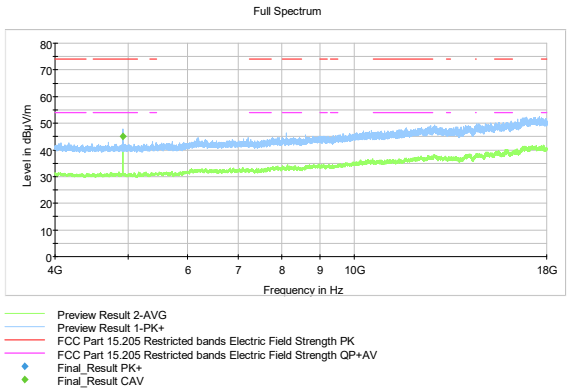

Figure 12: HIGH channel b mode (4 GHz – 18 GHz)

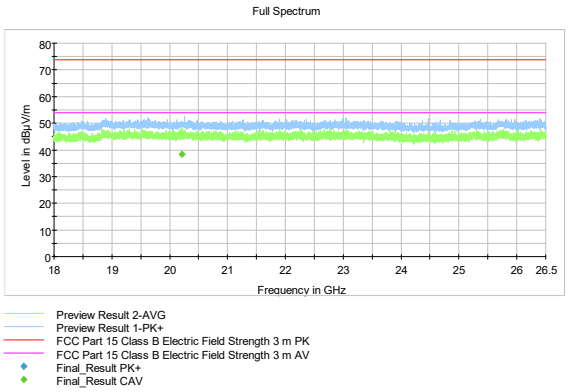

Figure 13: HIGH channel b mode (18 GHz – 26.5 GHz)

Table 7: Average results HIGH channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4924.000000	45.17	54.00	8.83	1000.0	1000.000	138.0	V	4.0	7.3
20205.600000	38.46	53.90	15.44	1000.0	1000.000	170.0	V	73.0	6.8

Radiated lower and upper band edge results

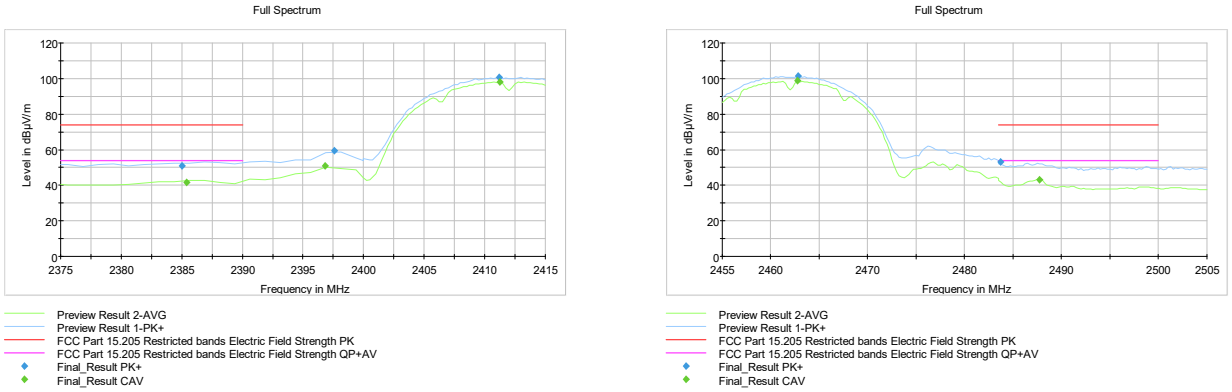

Figure 14: Radiated lower and upper band edge results, b mode

Table 8: Peak results Radiated lower and upper band edge results

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Result
2462.8	101.33	---	---	1000	1000	152	V	65	13.8	PASS
2483.7	53.08	74	20.92	1000	1000	188	V	112	13.6	PASS
2385	50.91	74	23.09	1000	1000	212	V	52	13.3	PASS
2397.6	59.51	70.61	11.1	1000	1000	179	V	128	13.7	PASS
2411.2	100.61	---	---	1000	1000	158	V	61	13.9	PASS

Table 9: Average results Radiated lower and upper band edge results

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Result
2462.75	98.65	---	---	1000	1000	152	V	63	13.8	PASS
2487.7	42.97	54	11.03	1000	1000	153	V	98	13.5	PASS
2385.4	41.61	54	12.39	1000	1000	202	V	82	13.4	PASS
2396.8	50.98	68.17	17.19	1000	1000	121	V	244	13.7	PASS
2411.25	98.17	---	---	1000	1000	157	V	61	13.8	PASS

Power Spectral Density

Standard:	ANSI C63.10	(2013)
Tested by:	MIH	
Date:	27 August 2021	
Temperature:	22.3 °C	
Humidity:	48.9 % RH	

FCC Rule: 15.247(e)
RSS-247 5.2(b)

Results:

Table 10: Power spectral density test results

Test mode	Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]	Result
802.11b_1Mbps	1 Low	**1.396**	**+8.00**	**PASS**
	6 Mid	**1.128**		**PASS**
	11 High	**1.124**		**PASS**
802.11g_6Mbps	1 Low	**-4.525**		**PASS**
	6 Mid	**0.669**		**PASS**
	11 High	**-4.330**		**PASS**
802.11n_6.5 Mbps	1 Low	**-4.282**		**PASS**
	6 Mid	**-0.056**		**PASS**
	11 High	**-4.215**		**PASS**

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2412.000000	**2413.025000**	**1.396**	**8.0**	**PASS**

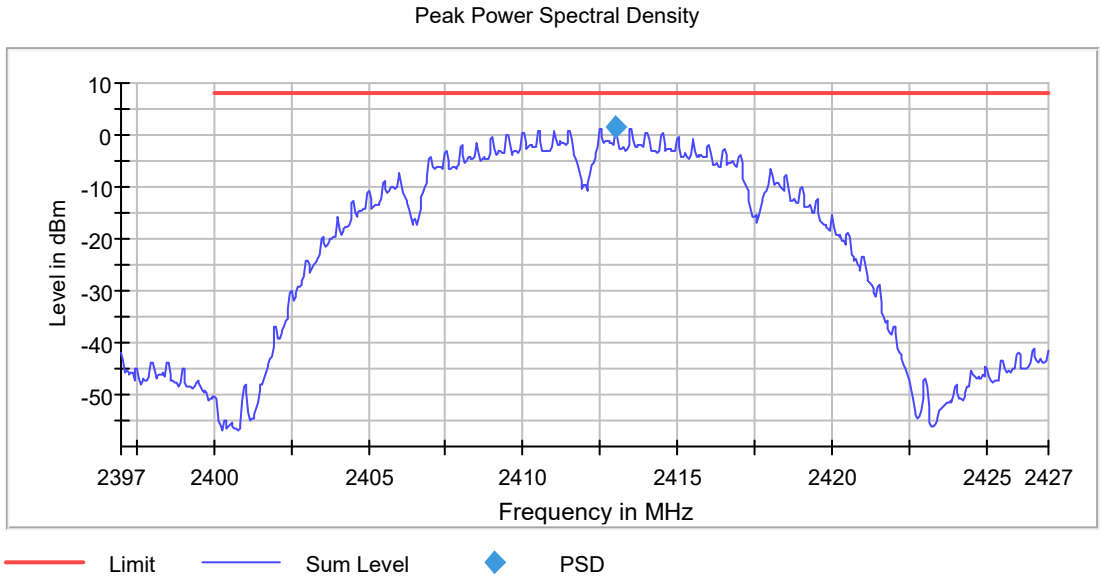

Figure 15: Power spectral density, channel LOW, b mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2437.525000	1.128	8.0	PASS

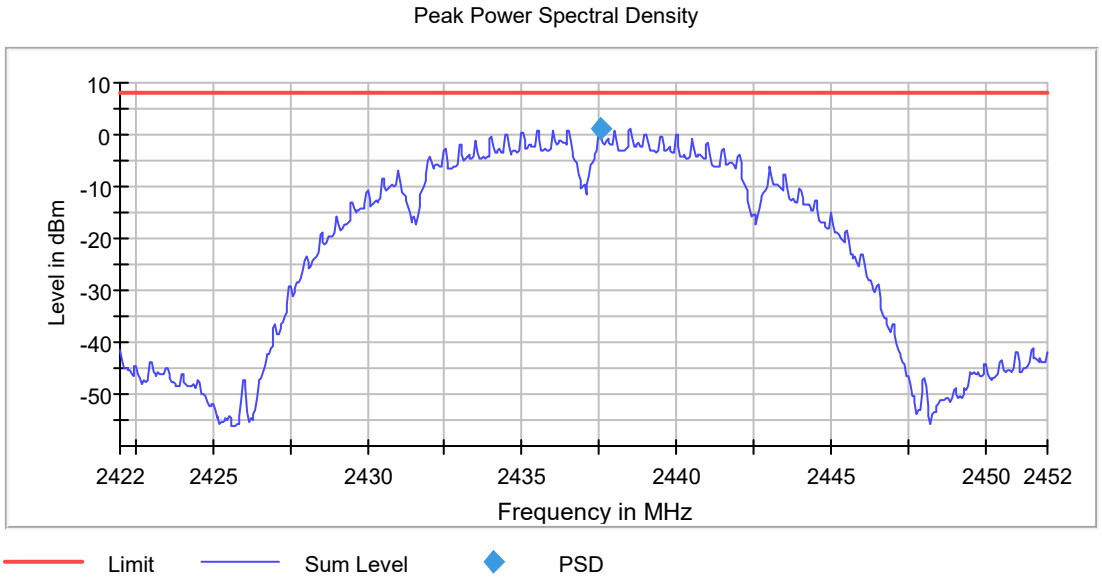

Figure 16: Power spectral density, channel MID, b mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2462.000000	2461.025000	1.124	8.0	PASS

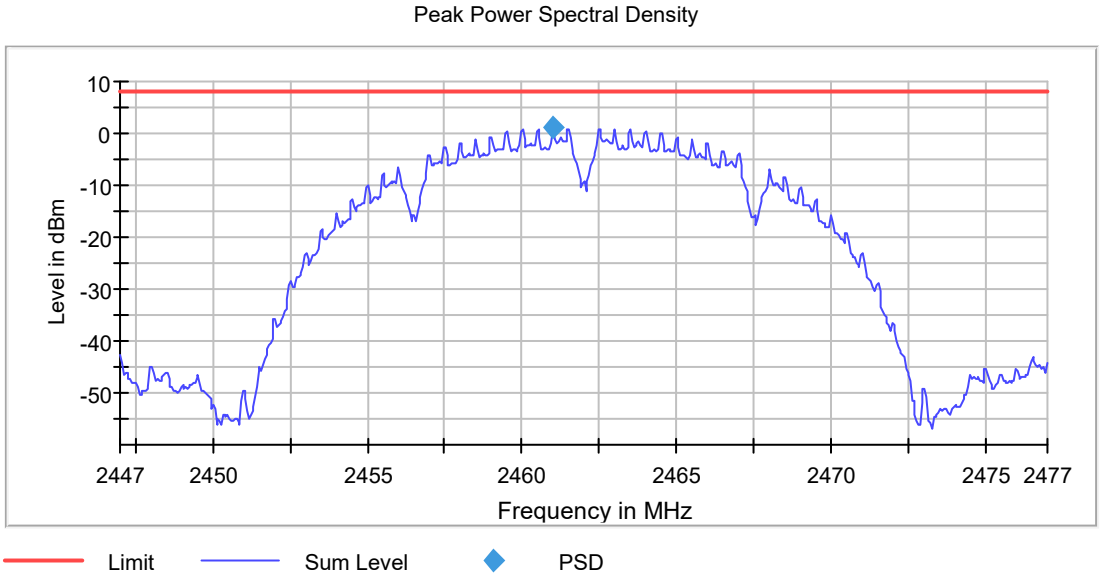

Figure 17: Power spectral density, channel HIGH, b mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2412.000000	2410.725000	-4.525	8.0	PASS

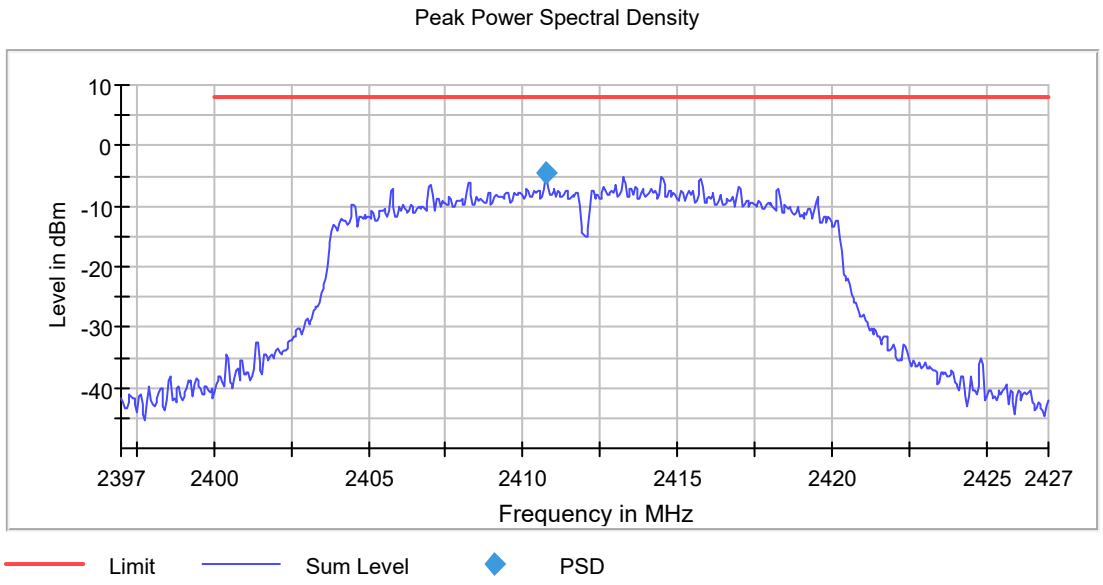

Figure 18: Power spectral density, channel LOW, g mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2435.725000	0.669	8.0	PASS

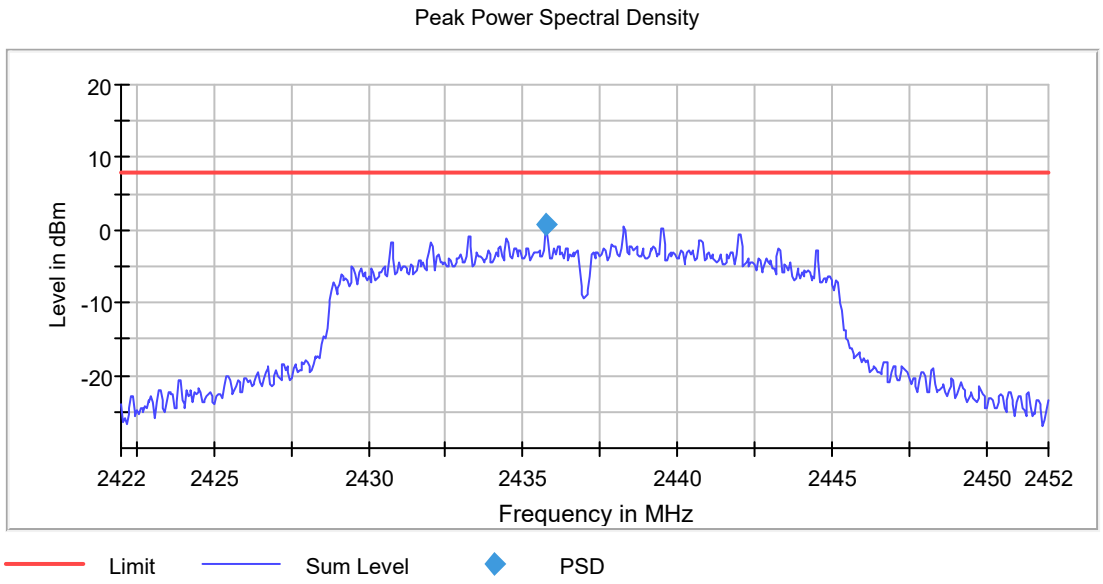

Figure 19: Power spectral density, channel MID, g mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2462.000000	2460.725000	-4.330	8.0	PASS

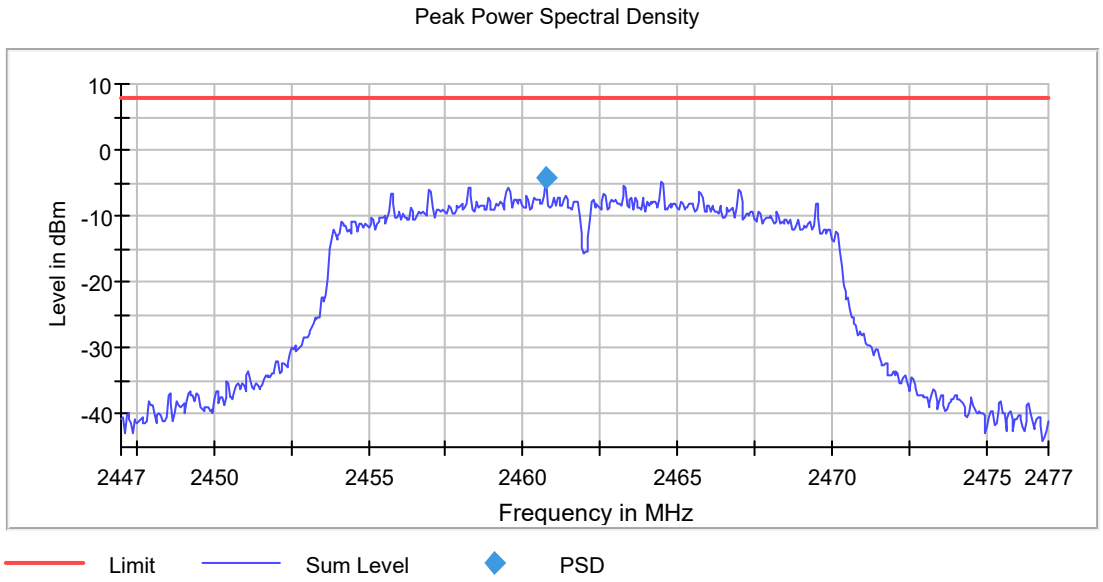

Figure 20: Power spectral density, channel HIGH, g mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2412.000000	2410.725000	-4.282	8.0	PASS

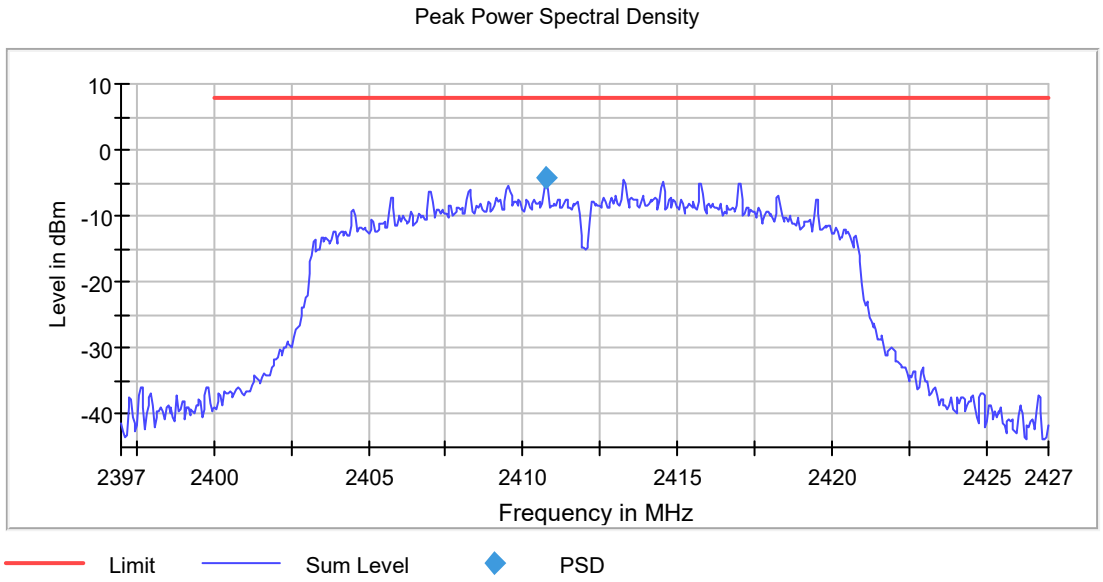

Figure 21: Power spectral density, channel LOW, n mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2437.000000	2438.275000	-0.056	8.0	PASS

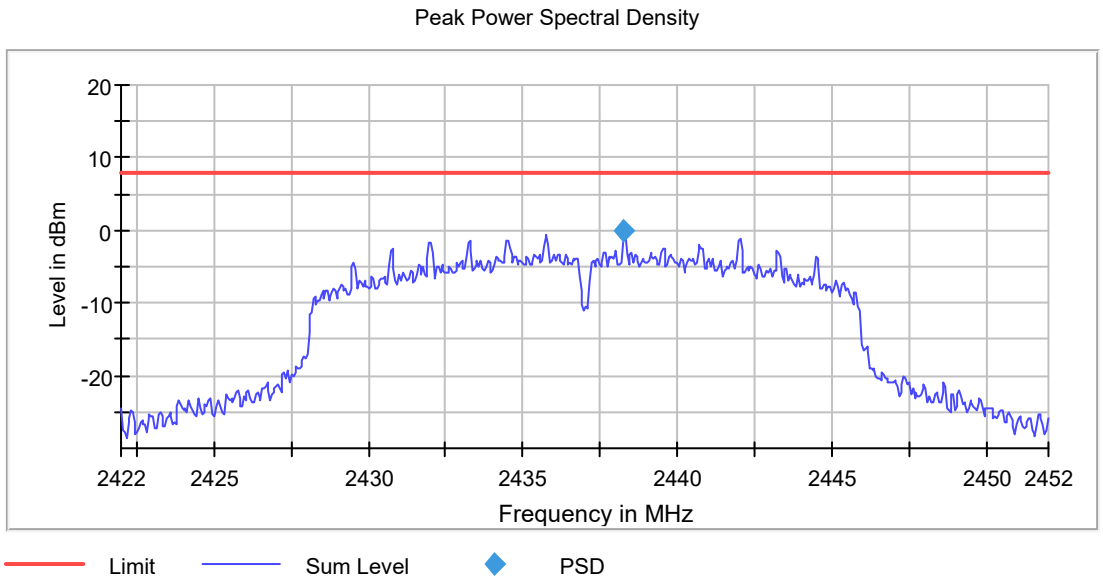

Figure 22: Power spectral density, channel MID, n mode

Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2462.000000	2460.775000	-4.215	8.0	PASS

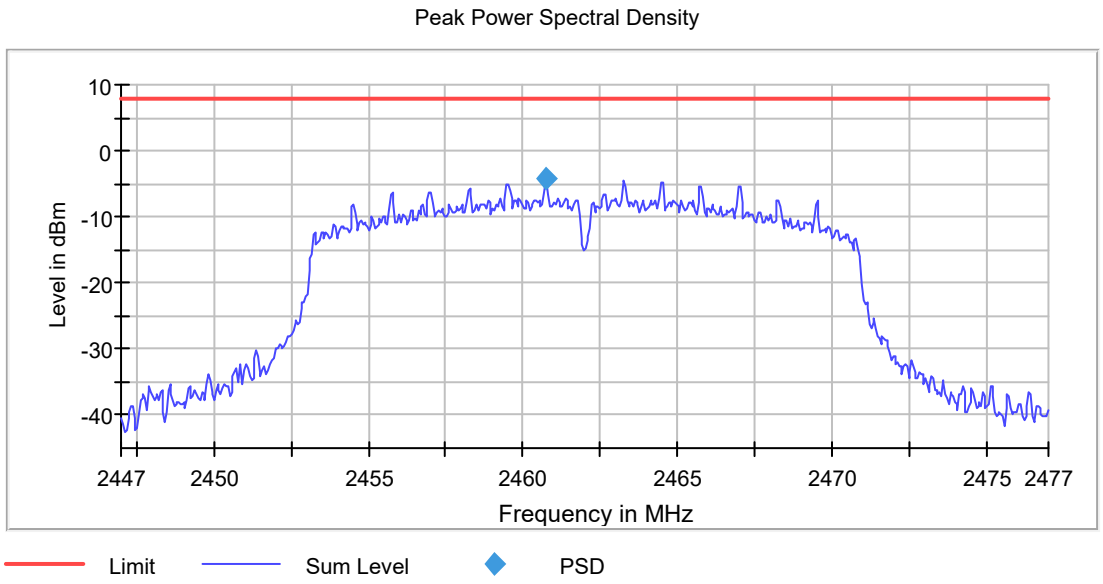

Figure 23: Power spectral density, channel HIGH, n mode

Table 11: Measurement settings, Power spectral density

Setting	Instrument Value	Target Value
Span	3.000 MHz	3.000 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	600	~ 600
Sweeptime	3.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	3 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.32 dB	0.50 dB

TEST EQUIPMENT

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ANTENNA	A.H. SYSTEMS	SAS-200/518	inv:7873	NCR	NCR
SPECTRUM ANALYZER	AGILENT	E7405A	inv:9746	2020-2-17	2022-2-17
ANTENNA	EMCO	3117	inv:7293	2020-3-11	2022-3-11
ATTENUATOR	HUBER&SUHNER	6830.19.A	inv:10394	2021-1-25	2023-1-25
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW 26	inv:10679	2021-6-21	2022-6-21
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv:10881	2021-6-22	2022-6-22
OSP BASE UNIT	ROHDE & SCHWARZ	OSP120	inv:10882	2021-3-24	2023-3-24
OSP-B157W 8 PORT	ROHDE & SCHWARZ	OSP-B157W8	inv:10883	2021-3-19	2023-3-19
OSP-B157WX	ROHDE & SCHWARZ	OSP-B157WX	inv:10884	2021-3-24	2023-3-24
RF SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	inv:9288	2021-06-18	2022-06-18
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	inv:9290	2019-06-27	2022-06-27
POWER SUPPLY	THANDAR	TS3021S	sn:099610	NCR	NCR
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2021-07-08	2022-07-08
MULTIMETER	BECKMAN	DM95	inv:8255	2020-11-9	2021-11-9

Radiated Emissions

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Equipment
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv:7826	NCR	NCR
RF PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2020-10-09	2021-10-09
RF PREAMPLIFIER	CIAO	CA1840-5019	inv:10593	2020-10-09	2021-10-09
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv:10517	2020-11-11	2021-11-11
ANTENNA	EMCO	3117, emi 1-18GHz	inv:7293	2020-03-11	2022-03-11
ANTENNA	EMCO	3160-09, emi 18-26.5GHz	inv:7294	2021-02-19	2022-02-19
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	NCR	NCR
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	NCR	NCR
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	NCR	NCR
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv:10126	2021-03-26	2022-03-26
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2021-06-21	2022-06-21
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2020-10-28	2022-10-28
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2020-11-04	2022-11-04
ATTENUATOR	PASTERNACK	10 dB, DC-40 GHz	sn:A1	2021-04-20	2023-04-20
FILTER	WAINWRIGHT	HP, WHKX4.0/18G-10SS	inv:10403	2021-01-29	2023-01-29

NCR = No calibration required

END OF REPORT