Test Report

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

Equipment Under Test:	RFID reader module
Model:	9CD 3.0
Manufacturer:	Idesco Oy Teknologiantie 9 FI-90590 Oulu Finland
Customer:	Idesco Oy Teknologiantie 9 FI-90590 Oulu Finland
FCC Rule Part:	15.209, 15.225
IC Rule Part:	RSS-210, Issue 10, 2019 RSS-GEN Issue 5 Amendment 1, 2019

Date:	31 March 2021	Date:	31 March 2021
Issued by:	Mikko Halonen Development Engineer	Checked by:	Rauno Repo Senior EMC Specialist

Table of Contents

GENERAL REMARKS

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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	12 August 2020
1.1	Corrections made based on TCB comments	6 October 2020
1.3	Transmitter Radiated Spurious Emissions tests 9kHz-30MHz with s/n 2507	19 November 2020
1.4	The correct levels of fundamental emission for comparison to unwanted emissions in the 30 – 1000 MHz frequency range added (Page 11)	31 March 2021

PRODUCT DESCRIPTION

Equipment Under Test

Trademark:	9CD 3.0 with antenna ATH or antenna ATHC
Model:	9CD 3.0
Type:	RFID Device
Serial no:	413 578 and 2507
FCC ID:	UJR9CD30
IC:	6701A-9CD30
Antenna 1:	ATHC antenna (Cylinder antenna)
Antenna 2:	ATH antenna (PCB antenna)

General Description

13.56 MHz circuit board RFID reader unit

Classification

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):	13.56 MHz
Channels:	1 transmit channel
Channel separation:	-
Transmission technique:	-
Modulation:	-
Antenna 1 type:	Cylinder antenna
Antenna 2 type:	PCB loop antenna

Power Supply

Operating voltage range:	24 VDC
Operating voltage AC/DC power supply:	120VAC 60Hz
type: Lenovo, model: ADLX65NCT3A	output 20VDC (used only during conducted emissions test)

Cables

Cable:	**Length:**	**Type:**
power / data cable	2.7m +1.8m	unshielded cable
Antenna cable	0.14m	unshielded cable
AC power	0.9m	unshielded cable

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.203	Antenna requirement	**PASS**
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	**PASS**
§15.225	Frequency Stability	**PASS**
RSS-GEN 6.7	99% Occupied Bandwidth	**PASS**
§15.209(a), §15.205 / RSS-210 7.2	Radiated Emissions Within the Restricted Bands	**PASS**

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

Test	Operating mode
Conducted Emissions on Power Supply Lines	continuous transmit mode, PCB Antenna without TAG. Powered by AC/DC adapter (20 VDC).
Frequency Stability	continuous transmit mode, PCB Antenna without TAG Powered by laboratory power supply (24VDC).
99% Occupied Bandwidth	continuous transmit mode, PCB Antenna without TAG Powered by laboratory power supply (24VDC).
Radiated Emissions Within the Restricted Bands	This test was done separately to both antennas. During the tests the EUT was in continuous transmit mode and it was powered by laboratory power supply (24VDC). The pre-measurements were performed with the EUT being in three orthogonal positions (X, Y, Z). Measurements were performed to both antennas with TAG and without TAG. Final measurements were done in worst position. 1. PCB antenna, without TAG 2. Cylinder antenna, with TAG

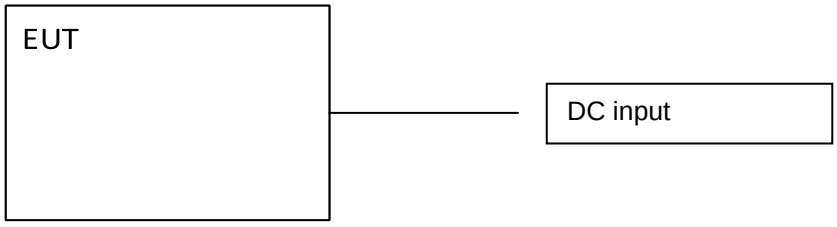

Figure 1: Test setup blocking diagram

Table 1. Normal and extreme test conditions

Test conditions:		Temperature [ºC]:	Voltage [V]:	Frequency [Hz]:
Normal		20 - 25	24	DC
Extreme	Minimum	-20	8.5	
	Maximum	+50	30	

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

Antenna requirement

Standard: FCC Rule §15.203
Tested by: JAT
Date: 7 August 2020

FCC Rule: 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Specification	Requirement (at least one of the following shall be applied)	Conclusion
§15.203	1. Permanently attached antenna 2. Unique coupling to the intentional radiator 3. Professionally installed radio. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	**PASS**
Note	Option 3 is used	

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	29 July 2020	
Temperature:	23 ± 3°C	
Humidity:	20 - 60 % RH	
Barometric pressure:	1001 hPa	
Measurement uncertainty:	± 2.9 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.207 (a)
RSS-GEN 8.8

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors. During the test, EUT was powered by Lenovo ADLX65NCT3A AC/DC adapter (20VDC). Input voltage to AC/DC adapter was 120VAC 60Hz.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

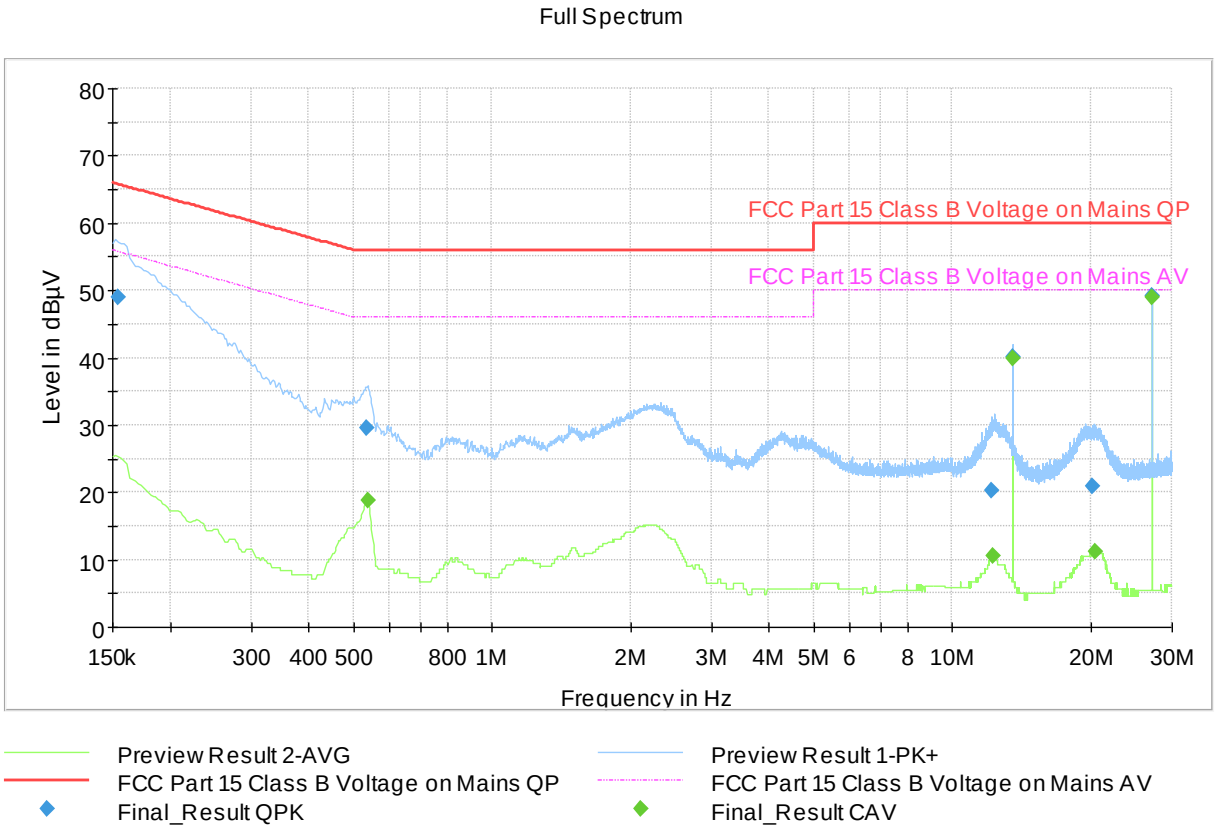

Figure 2: The measured curves with peak- and average detector, PCB antenna without TAG

Final measurements from the worst frequencies

Table 2: Final QuasiPeak and Average measurements from the worst frequencies, PCB antenna without TAG

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.154000	49.03	---	65.78	16.75	1000.0	9.000	N	ON	9.6	-
0.536000	29.46	---	56.00	26.54	1000.0	9.000	L1	ON	9.7	-
0.537750	---	18.72	46.00	27.28	1000.0	9.000	L1	ON	9.7	-
12.131000	20.31	---	60.00	39.69	1000.0	9.000	L1	ON	10.3	-
12.242000	---	10.46	50.00	39.54	1000.0	9.000	L1	ON	10.3	-
13.558500	---	39.97	50.00	10.03	1000.0	9.000	N	ON	10.3	Fundamental
13.558500	40.16	---	60.00	19.84	1000.0	9.000	N	ON	10.3	Fundamental
20.129750	20.91	---	60.00	39.09	1000.0	9.000	N	ON	10.6	-
20.416500	---	11.19	50.00	38.81	1000.0	9.000	L1	ON	10.4	-
27.119250	49.12	---	60.00	10.88	1000.0	9.000	L1	ON	10.6	-
27.119250	---	48.94	50.00	1.06	1000.0	9.000	L1	ON	10.6	-

The correction factor in the final result table contains the sum of the transducers (transient limiter + cables).
The result value is the measured value corrected with the correction factor.

Transmitter Radiated Spurious Emissions 9 kHz - 1000 MHz

Standard:	ANSI C63.10 (2013)	
Tested by:	JAT, PKA	
Date:	28 – 29 July 2020 and 19 November 2020	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	
Measurement uncertainty:	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.225(a), (b), (c), (d), 15.209(a)

RSS-210 7.2

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).

According to ANSI C63.10 (clause 5.3.2) and RSS-Gen (Clause 6.5) the measurements below 30 MHz can be performed at a closer distance than the EUT limit distance, the results shall be extrapolated to limit distance by using the square of an inverse linear distance extrapolation factor (40 dB/ decade). This method was used when performing measurements at a distance of 3 m instead of limit distances 300 m or 30 m.

According to §15.209(c) any unwanted emission shall not exceed the level of the fundamental emission. As the measurement has been made from 3m distance and the result has been extrapolated by -40 dB to the 30 meter distance, the correct levels of fundamental emission for comparison to unwanted emissions in the 30 – 1000 MHz frequency range are:
PCB Antenna without TAG: 65.52 dBµV/m
Cylinder antenna with TAG: 43.25 dBµV/m

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.

The pre-measurements were performed with the EUT being in three orthogonal positions (X, Y, Z). Measurements were performed to both antennas with TAG and without TAG. Final measurements were done in worst position.

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector
0.009-0.490	2400/F(kHz)	300	Quasi-peak
0.490-1.705	24000/F(kHz)	30	Quasi-peak
1.705-30.0	30	30	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

Test results

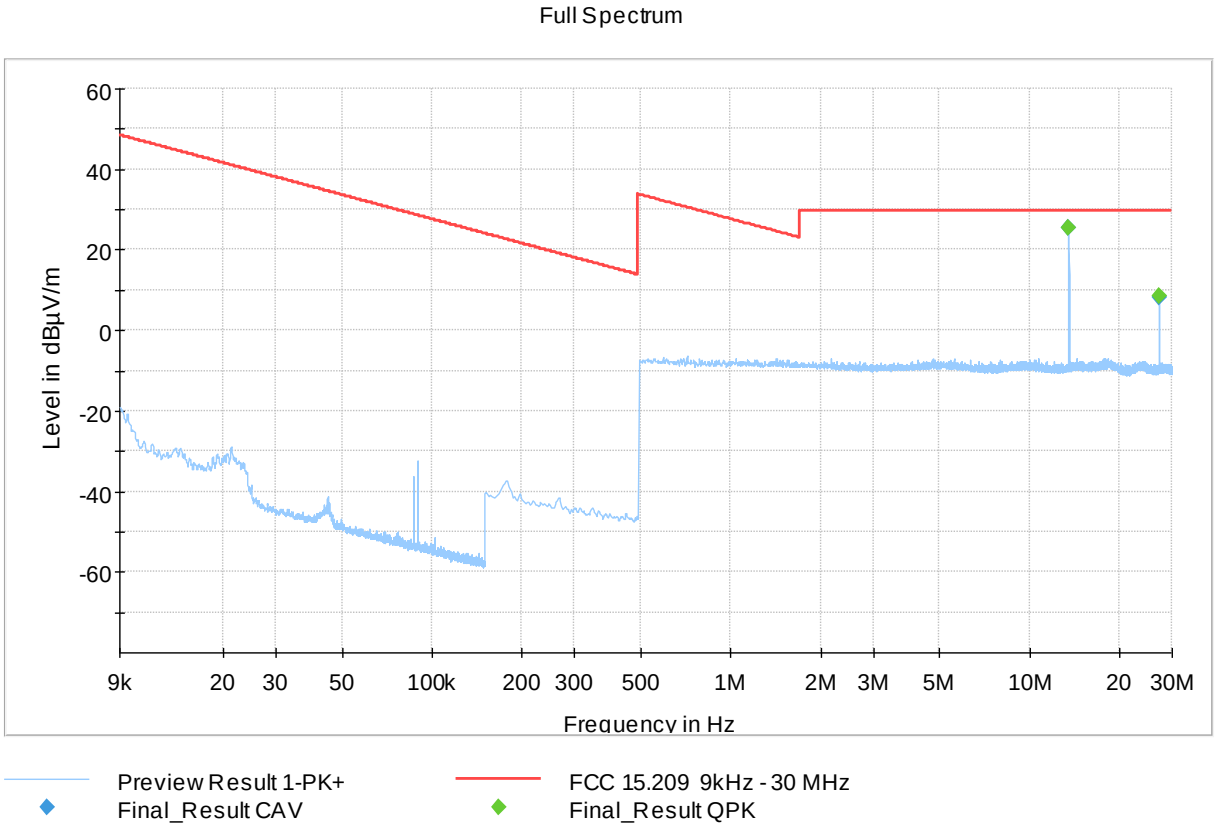

Figure 3. TX radiated emission 9 kHz to 30MHz, PCB antenna without TAG

Final measurements from the worst frequencies

Table 3. The final results with Quasipeak detector, PCB antenna without TAG

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.559000	25.52	29.50	3.98	1000.0	9.000	190.0	V	175.0	-20.1
27.119750	8.35	29.50	21.15	1000.0	9.000	100.0	V	149.0	-19.6

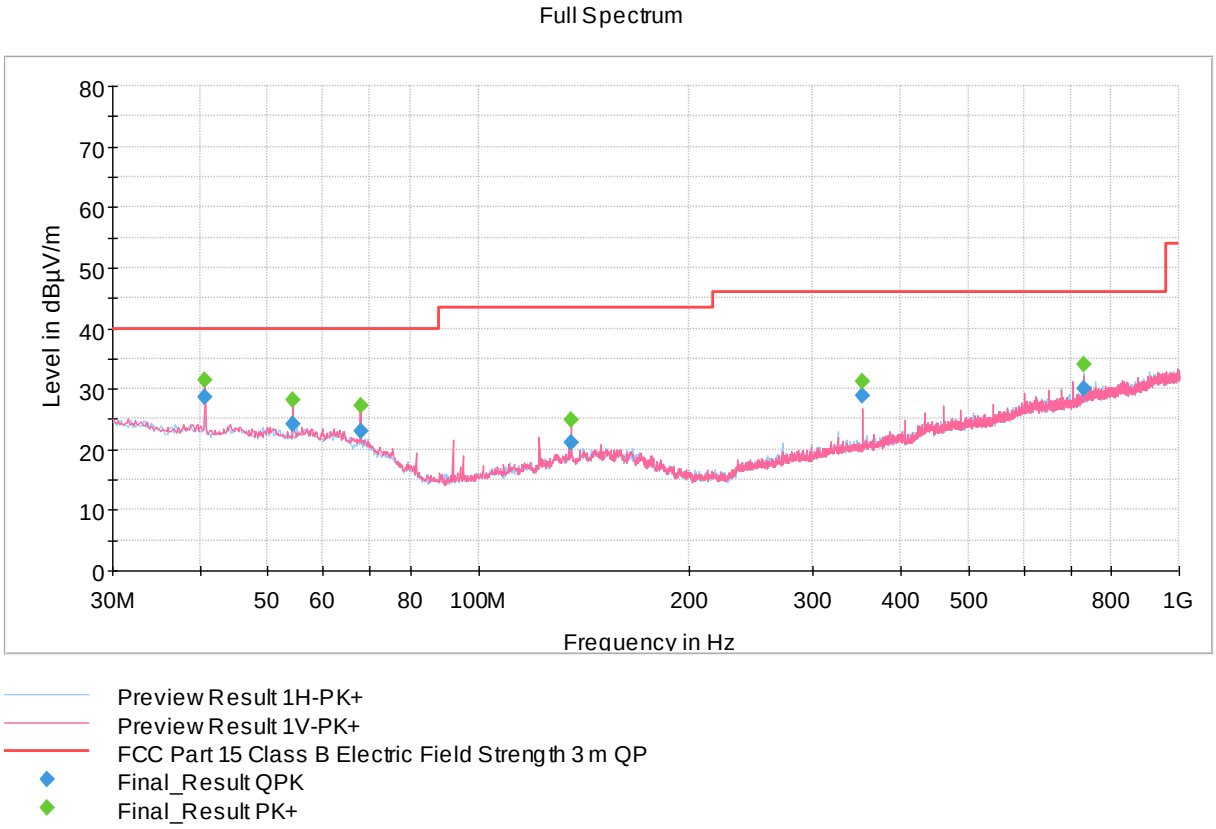

Figure 4. TX radiated emission 30 MHz to 1000 MHz, PCB antenna without TAG

Table 4. The final results with Quasipeak detector, PCB antenna without TAG

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
40.685000	28.54	40.00	11.46	1000.0	120.000	100.0	V	102.0	17.2	-
54.245000	24.11	40.00	15.89	1000.0	120.000	105.0	V	262.0	17.9	-
67.815000	22.88	40.00	17.12	1000.0	120.000	120.0	V	157.0	16.7	-
135.595000	21.17	43.50	22.33	1000.0	120.000	111.0	V	108.0	17.5	-
352.575000	28.81	46.00	17.19	1000.0	120.000	152.0	V	326.0	20.6	-
732.265000	30.13	46.00	15.87	1000.0	120.000	212.0	H	158.0	29.1	-

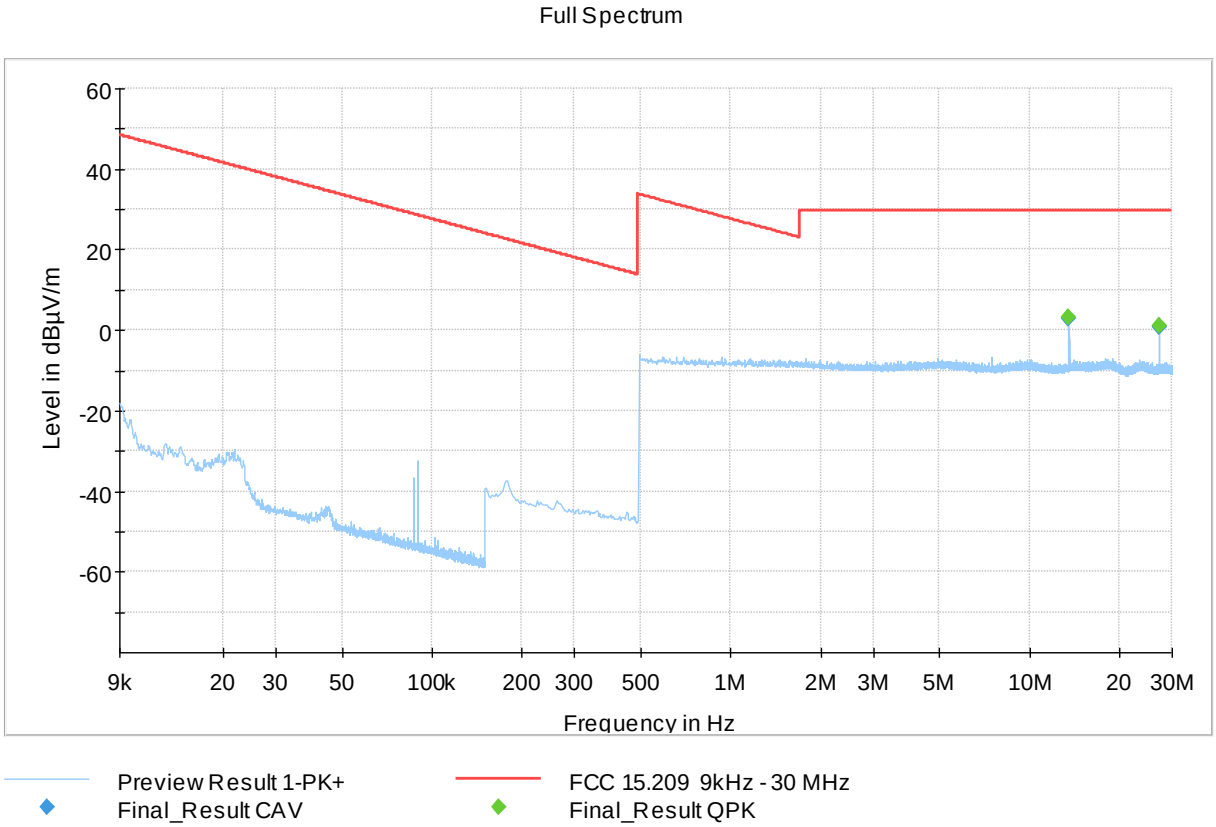

Figure 5. TX radiated emission 9 kHz to 30MHz, Cylinder antenna with TAG

Final measurements from the worst frequencies

Table 5. The final results with Quasipeak detector, Cylinder antenna with TAG

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.559000	3.25	29.50	26.25	1000.0	9.000	100.0	V	143.0	-20.1
27.121500	1.22	29.50	28.28	1000.0	9.000	100.0	V	140.0	-19.6

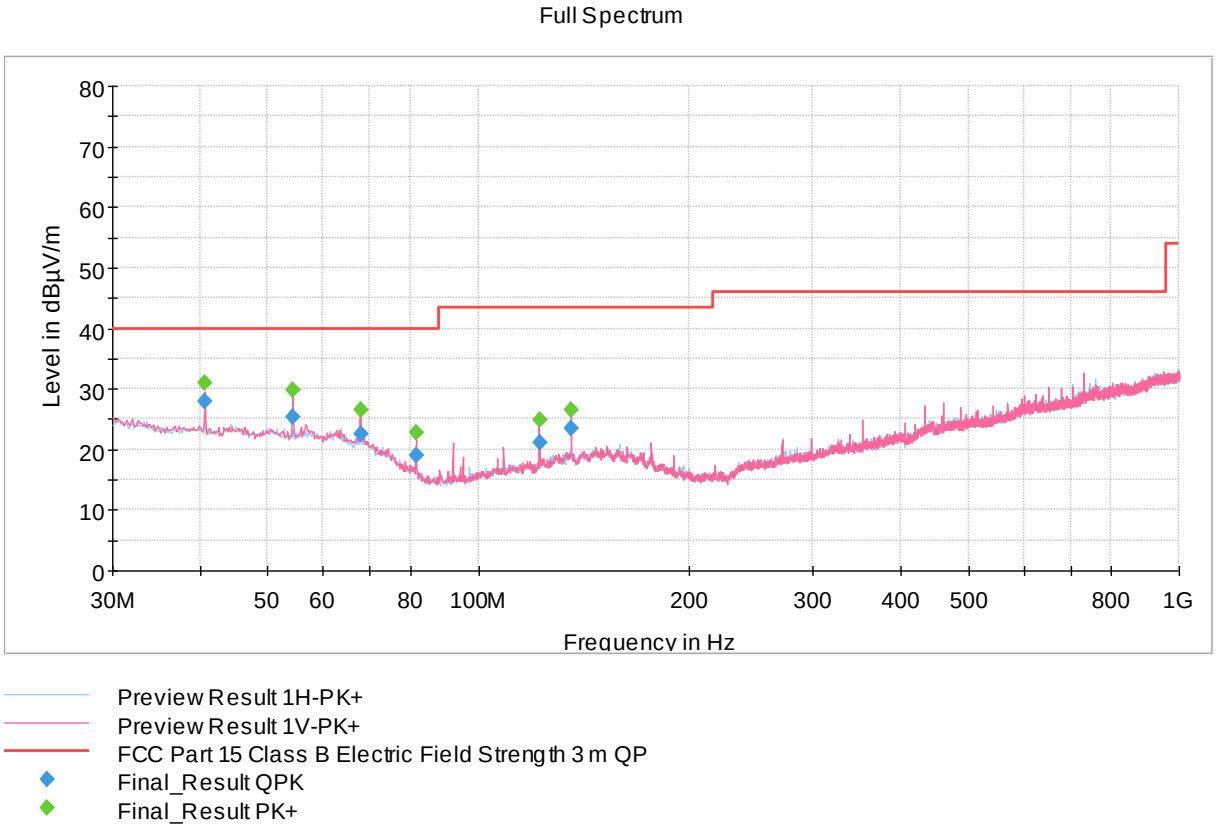

Figure 6. TX radiated emission 30 MHz to 1000 MHz, Cylinder antenna with TAG

Table 6. The final results with Quasipeak detector, Cylinder antenna

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
40.685000	27.86	40.00	12.14	1000.0	120.000	100.0	V	186.0	17.2	-
54.245000	25.28	40.00	14.72	1000.0	120.000	100.0	V	319.0	17.9	-
67.795000	22.59	40.00	17.41	1000.0	120.000	111.0	V	116.0	16.7	-
81.355000	19.05	40.00	20.95	1000.0	120.000	100.0	V	10.0	12.8	-
122.065000	21.05	43.50	22.45	1000.0	120.000	111.0	V	305.0	15.9	-
135.595000	23.35	43.50	20.15	1000.0	120.000	100.0	V	109.0	17.5	-

Frequency Stability

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	29 July 2020	
Temperature:	22.7 °C	
Humidity:	62 % RH	

FCC Rule: 15.225(e)
IC Rule: RSS-210, RS-GEN (6.11)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01% of the operating frequency over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test results

Table 7. Frequency stability test, extreme conditions. PCB antenna without TAG

Test conditions		Frequency	deviation from nominal	Result
Temperature [°C]	Voltage [VDC]	MHz	%	
-20	24	13.5604532	0.003342183	PASS
-10	24	13.5604930	0.003635693	PASS
0	24	13.5605039	0.003716077	PASS
+10	24	13.5604982	0.003674041	PASS
+20	8.5	13.5604771	0.003518437	PASS
+20	24	13.5604701	0.003466814	PASS
+20	30	13.5604739	0.003494838	PASS
+30	24	13.5604655	0.003432891	PASS
+40	24	13.5604520	0.003333333	PASS
+50	24	13.5604540	0.003348083	PASS

99% Occupied Bandwidth

Standard:	RSS-GEN	(2019)
Tested by:	JAT	
Date:	29 July 2020	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	

RSS-GEN 6.7

Results

Table 8. 99% occupied bandwidth test results, PCB antenna without TAG

Channel	Limit	99 % BW [kHz]	Result
13.56 MHz	-	9.444704853	PASS

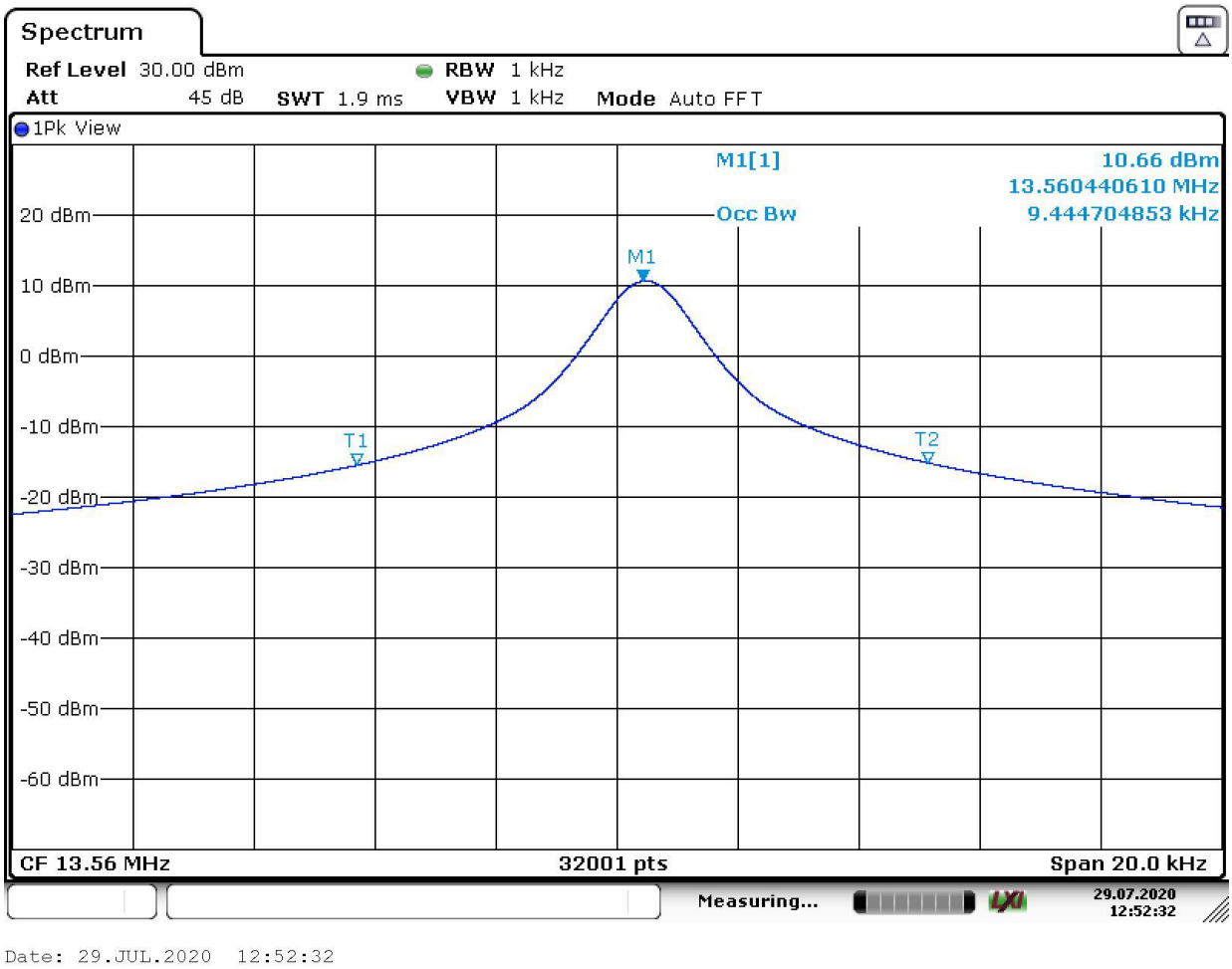

Figure 7: 99% OBW

TEST EQUIPMENT

Conducted Emissions

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
LISN	ROHDE & SCHWARZ	ENV216	inv:9611	2020-03-03	2021-03-03
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2020-07-20	2021-07-20
POWER SUPPLY	CALIFORNIA INSTR.	5001i-400	inv:9488	NCR	NCR

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, monitoring	inv:9746	2018-01-08	NCR
TEMPERATURE CHAMBER	CTS	T-65/50	inv:10521	NCR	NCR
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 EMC	inv:10516	2019-11-07	2020-11-07
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv:10517	2019-11-07	2020-11-07
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
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2020-07-20	2021-07-20
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2019-11-18	2020-11-18
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2	inv:8013	2018-10-30	2020-10-30
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2	inv:8013	2020-10-28	2022-10-28
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2018-10-25	2020-10-25
POWER SUPPLY	THANDAR	PL330TP	inv:9787	NCR	NCR
POWER SUPPLY	DELTA	SM 130-25D	inv:10406	NCR	NCR
MULTIMETER	FLUKE	21	inv:8253	2019-10-30	2020-10-30

NCR = No calibration required

END OF REPORT