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SIST EN ISO/IEC 17025
LP-009

Test report

Number:	**T251-0651/16 A1**	Project file:	C20160767
		Date:	2016-09-30
		Pages:	45
Product:	**RFID Reader Module**		
Type reference:	**Metra Reader Module RFID ISO**		
Ratings:	5 VDC (powered from host unit via SPI) Protection class: III.		
Trademark:	Metra MEW System		
Applicant:	**Metra inženiring d.o.o.** **Špruha 19, IOC Trzin, SI-1236 Trzin, Slovenia**		
Manufacturer:	Metra inženiring d.o.o. Špruha 19, IOC Trzin, SI-1236 Trzin, Slovenia		
Place of manufacture:	Metra inženiring d.o.o. Špruha 19, IOC Trzin, SI-1236 Trzin, Slovenia		

Summary of testing

Testing method:	FCC Part 15, Subpart C
Testing location:	SIQ Ljubljana, Trpinčeva ulica 37 A, SI-1000 Ljubljana, Slovenia
Remarks:	Date of receipt of test items: 2016-01-06 Number of items tested: 1 Date of performance of tests: 2016-01-08 - 2016-03-10, 2016-09-30 The test results presented in this report relate only to the items tested. The product complies with the requirements of the testing methods. /

Tested by: Andrej Škof **Approved by:** Marjan Mak

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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2016-06-06	T251-0651/16	Initial Test Report issued.	--
2016-09-30	T251-0651/16 A1	Corrected test report: Added: - Conducted emission measurements with dummy load - Test summary table - Antenna requirements compliance as per 15.203 - Compliance summary table - Reference to ANSI C63.10:2013 - Note regarding antenna corrections factor and cable loss Modified: - Radiated emission limit table - Test procedure for Radiated emission measurements Deleted: Reference to Clause 15.249	1.0

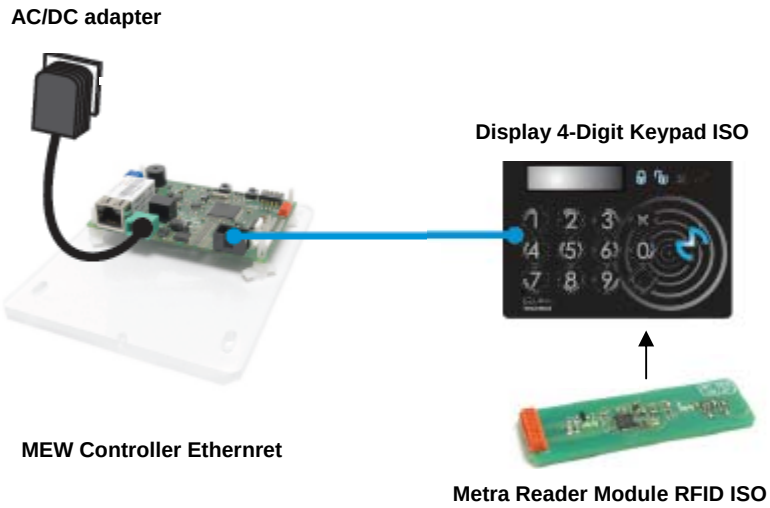
Environmental conditions:
Ambient temperature: 15°C to 35°C
Relative humidity: 30% to 60%
Atmospheric pressure: 860 mbar to 1060 mbar

1.1 Equipment under test

RFID Reader Module
Type: Metra Reader Module RFID ISO
FCC ID: 2ABT80005P939

Tested sample SIQ number: S20160163
Note: During testing EUT connected to Display 4-Digit Keypad ISO manufactured by Metra inženiring d.o.o. MEW Controller Ethernet powered via AC/DC adapter PHIHONG, Model: PSC30R-120.

Block scheme of test setup:



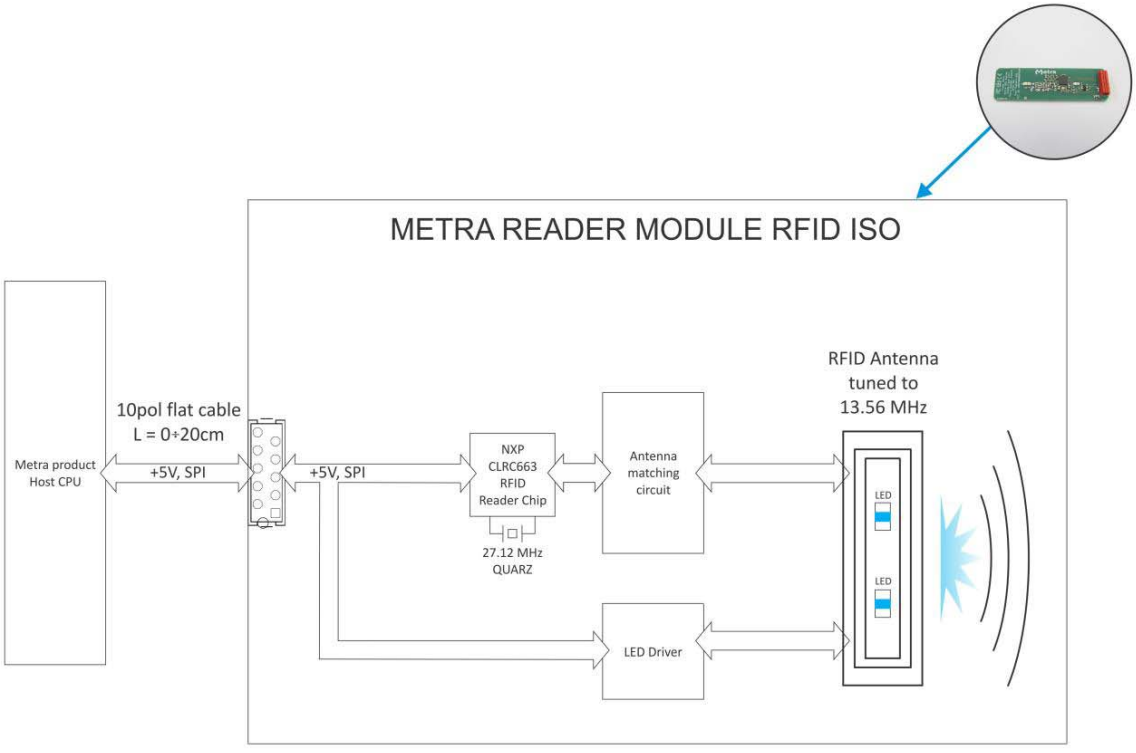
General product information

Antenna Requirements (15.203): Metra Reader Module RFID ISO has PCB antenna and can not be replaced by end user.

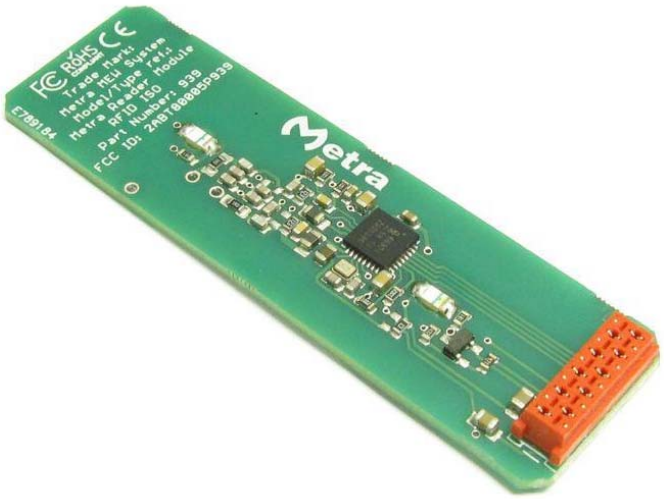
Metra Reader Module RFID ISO is module that is intended for Metra internal use only, to be integrated into products that need RFID functionality.

The module is connected to the Metra product main board via 10-pole flat cable. The cable length is maximum 20 cm. It is based on NXP RFID chip “CLRC663” that is complete RFID reader solution with its own 27,12 MHz oscillator and controlled by SPI serial communication. It has integrated PCB type RFID antenna and 13.56 MHz tuning circuit as well as two LEDs indicating to the user antenna area where to approach the RFID media. It is powered by 5 VDC provided via Flat Cable.
The SPI commands are generated by the host CPU located on the Metra product main board. Test scenario was made using typical Metra product based on Cortex-M processor and generating all different SPI commands that can be used in the real product.

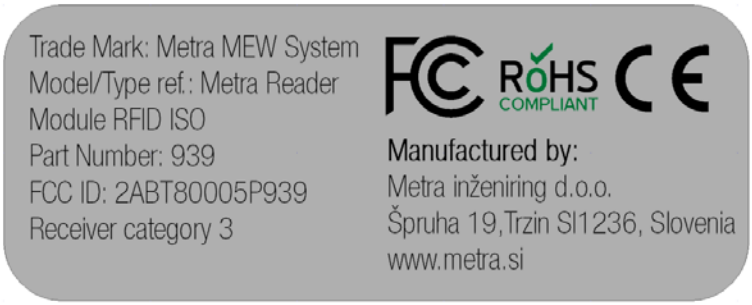
Hardware Version:
939 – METRA_READER Ver. 1
Software Version:
Defined by each Metra final product, where the module is integrated in. Tested by maximum functionality test firmware.
Processor Used:
NXP CLRC663 RFID Reader Chip. Quartz oscillator 27.12 MHz divided by 2 to obtain RFID operating frequency 13.56 MHz.



Block scheme of EUT



Picture of EUT



Picture of label

1.2 ANSI C63.4 Subpart selection

Subpart C: Intentional Radiators

1.3 Class statement requirements

- The Class A statement cautions that operation of the device in a residential area is likely to cause harmful interference.
- The Class B statement offers several suggestions for minimizing interference to radio or TV receivers, including reorienting the receiving antenna and moving the Class B device farther away from the receiver.

1.4 Occupied bandwidth measurement

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

1.5 Quasi-peak detector

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	Full range (wideband)
10 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz

1.6 Peak, rms, and average detectors

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	10, 100, 1000 Hz
10 kHz to 150 kHz	1 and 10 kHz
150 kHz to 30 MHz	1 and 10 kHz
30 MHz to 1 GHz	10 and 100 kHz
1 GHz to 40 GHz	0.1, 1.0 and 10 MHz

2 LIMITS FOR ALL SUBPARTS

2.1 Subpart C: Intentional Radiators

Conducted emission limits (15.207):

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.5	66 – 56*	56 – 46*
0.5 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

Radiated emission limits (15.209):

Limits:

Frequency Range (MHz)	Limits (dBµV/m)	Test distance (m)
0,009 to 0,490	20*log(2400/F(kHz))	300
0,490 to 1,705	20*log(2400/F(kHz))	30
1,705 to 30,0	30	30
30 to 88	40**	3
88 to 216	43.5**	3
216 to 960	46**	3
Above 960	54	3

** Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

3 ALL TEST EQUIPMENT AND THEIR DESCRIPTION

3.1 General information

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESU8	105187	2015-11	2017-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU26	100428	2016-02	2018-02	24 months	/
Rohde & Schwarz, Artificial main network	ENV216	101194	2014-008	2016-08	24 months	X
ETS, Anechoic chamber	3m	103949	2014-11	2016-11	24 months	X
R&S, Antenna	HFH2-Z2	/	2015-09	2017-09	24 months	X
EMCO, Antenna	3142B	104351	2015-09	2017-09	24 months	X
EMCO, Antenna	3115	103002	2015-09	2017-09	24 months	/
Heinrich Deisel, Turn table	DS 420.00	103337	NA	NA	NA	X
Antenna tower	/	/	NA	NA	NA	X
Controller for turn table and antenna tower	/	/	NA	NA	NA	X

3.2 Other instrument information and auxiliary equipment

Description	Model No.	Bandwidth	Detector functions	Antenna factors	Cable loss	Range
Rohde-Schwarz, AMN	ENV216	/	/	/	/	9 kHz do 30 MHz
Rohde-Schwarz, RFI receiver	ESU8	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 8 GHz
Rohde-Schwarz, RFI receiver	ESU26	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 26.5 GHz
Hewlett Packard, RF Spectrum Analyzer	8593E	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	9 kHz – 26.5 GHz
Rohde & Schwarz, Artificial main network	ESH 2-Z5	/	/	/	/	9 kHz – 30 MHz
ETS, Anechoic chamber	3m	/	/	/	/	30 MHz – 18 GHz
EMCO, Antenna	model 3142	/	/	See tables below	/	26 MHz – 2 GHz
EMCO, Antenna	model 3115	/	/	See tables below	/	1 GHz – 18 GHz
Schwarzbeck Mess-Elektronik, Horn antenna	BBHA9120E	/	/	See tables below	/	450 MHz – 6 GHz
SIQ, Conducted emission cable	SIQ	/	/	/	See tables below	/
SIQ, Radiated emission cable	SIQ	/	/	/	See tables below	/

Cable loss and attenuation of radiated emission

3.2.1.1 Conducted emission cable (SIQ-K024)

Point	Frequency (9kHz-30MHz)	Cable length (meters)	Loss (dBm)
1	190 kHz	1	0,4
2	530 kHz	1	0,26
3	2,53 MHz	1	0,16
4	5,19 MHz	1	0,07
5	11,05 MHz	1	0,03
6	22,01 MHz	1	0,06
7	24,03 MHz	1	0,04

3.2.1.2 Radiated emission attenuation

Point	Frequency (30 MHz – 26,5 GHz)	Attenuation (dBm)
1	30 MHz	0,501
2	150 MHz	1,174
3	400 MHz	2,034
4	800 MHz	2,995
5	1 GHz	3,416
6	1,363	1,666667
7	2,686	3,58333
8	5,332	5,25
9	7,978	6,25
10	10,624	7,5
11	13,27	8,333333
12	15,916	9,166666
13	18,562	9,833333
14	21,208	10,66667
15	23,854	11,5
16	26,5	12,16667

4 CONVERSION FACTORS AND ALL OTHER FORMULAS

Unit	Conversion unit	Formula of conversion
dBμV	dBμV/m	dBμV/m = dBμV + AF
μV/m	dBμV/m	dBμV/m = 20log(X(μV/m)/1μV)

	Test distance stated in standard	Test distance of measurement	Conversion factor
Class B	3 m	3 m	/
Class A	10 m	3 m	20dB/decade

5 GENERAL AND SPECIAL CONDITIONS DESCRIPTION

5.1 General condition description

Interconnect and power cabling (or wiring)

Test arrangement for conducted emissions

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground-plane.
All other equipment powered from additional LISN(s).
Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
LISN at least 80 cm from nearest part of EUT chassis.

Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

Non-EUT components of EUT system being tested.

Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground-plane.

Test arrangement for conducted emissions- floor-standing equipment

Excess I/O cables shall be bundled in the center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling shall not exceed 40 cm in length.

Excess power cords shall be bundled in the center or shortened to appropriate length.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

EUT and all cables shall be insulated, if required, from the ground-plane by up to 12 mm of insulating material.

EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, the ground-plane.
All other equipment powered from a second LISN or additional LISN(s).
Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

Test arrangement for radiated emissions tabletop equipment

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground-plane.

Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

Non-EUT components of EUT system being tested.

Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

No vertical conducting plane used.

Power cords drape to the floor and are routed over to receptacle.

Test arrangement for radiated emissions floor-standing equipment

Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling not to exceed 40 cm in length.

Excess power cords shall be bundled in the center or shortened to appropriate length.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. If bundling is not possible, the cable shall be arranged in a serpentine fashion.

EUT and all cables shall be insulated, if required, from the ground-plane by up to 12 mm of insulating material.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground plane.

Overhead cable trays and suspended ceilings

Test arrangement for floor-standing equipment

Only one vertical riser may be used where typical of system under test.

Excess power cord shall be bundled in the center or shortened to appropriate length.

EUT and cables shall be insulated from ground-plane by up to 12 mm. Where the manual has specified or there exists a code of practice for installation of the EUT, the test arrangement shall allow the use of this practice for the tests.

Power cords being measured connected to one LISN. All other system power cords powered through other LISN(s). A multiple receptacle strip may be used for other power cords.

For *conducted* tests, the LISNs may be placed on top of or immediately beneath and bonded directly to the ground-plane. For *radiated* tests, the LISN(s), if used, should be installed under, with the receptacle flush with the ground-plane.

Placement and manipulation of interconnect cabling (or wiring) of tabletop equipment

LISN(s) may have to be positioned to the side of the table to meet the criterion that the LISN receptacle shall be 80 cm away from the EUT. LISN(s) may be above ground-plane only for conducted emission measurements.

Accessories, such as ac power adapter, if typically table-mounted, shall occupy peripheral positions as is applicable.

Accessories, which are typically floor-mounted, shall occupy a floor position directly below the portion of the EUT to which they are typically connected. T

Table length may be extended beyond 1.5 m with peripherals aligned with the back edge. The table depth may be extended beyond 1 m. The 40 cm distance to the vertical conducting plane shall be maintained for conducted emission testing.

Placement of wall-mounted equipment

Test configuration/arrangement for combination floor-standing and tabletop equipment

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground-plane.

Cables of hand-operated devices, such as keyboards, mice, etc., have to be placed as for normal use.

Non-EUT components of EUT system being tested.

I/O cable to floor-standing unit drapes to the ground-plane and shortened or excess bundled. Cables not reaching the metal ground-plane are draped to the height of the connector or 40 cm, whichever is lower.

Power cords and signal cables shall drape to the floor. No extension cords shall be used to the power receptacles.

The floor-standing unit can be placed under the table if its height permits.

5.2 Special condition description

If for some reason the above measurement conditions can’t be met, the description below should be used as an appropriate measurement condition and placement.

(Description is written additionally as the measurements differ – all is within test procedure)

6 TEST SUMMARY

STANDARDS (details on first page)	Tested yes	Tested no	Sample pass	Sample not pass
ANSI C63.10-2013; FCC Part 15, Subpart C	☑	☐	☑	☐

Test	FCC 47 CFR Part 15 section	**Section within the report**	**Conclusion**
Conducted emission	15.207	7.1	PASS
Radiated emission	15.209	7.2	PASS
Bandwidth of the emission	15.215	7.3	PASS
Spectrum mask	15.225	7.4	PASS
Frequency tolerance of the carrier signal	15.225	7.5	PASS

6.1 Operating voltages/frequencies used for testing

Section	**Test**	**Operating conditions**
7.1	Conducted emission	12 VDC (powered from host unit via SPI) AC/DC adapter: 120 V, 60 Hz
7.2	Radiated emission	12 VDC (powered from host unit via SPI) AC/DC adapter: 120 V, 60 Hz
7.3.	Bandwidth of the emission	12 VDC (powered from host unit via SPI) AC/DC adapter: 120 V, 60 Hz
7.4	Spectrum mask	12 VDC (powered from host unit via SPI) AC/DC adapter: 120 V, 60 Hz
7.5	Frequency tolerance of the carrier signal	10.2 VDC, 12.0 VDC, 13.8 VDC (powered from host unit via SPI)

7 EMISSION TESTS

7.1 Conducted emission measurement (15.207)

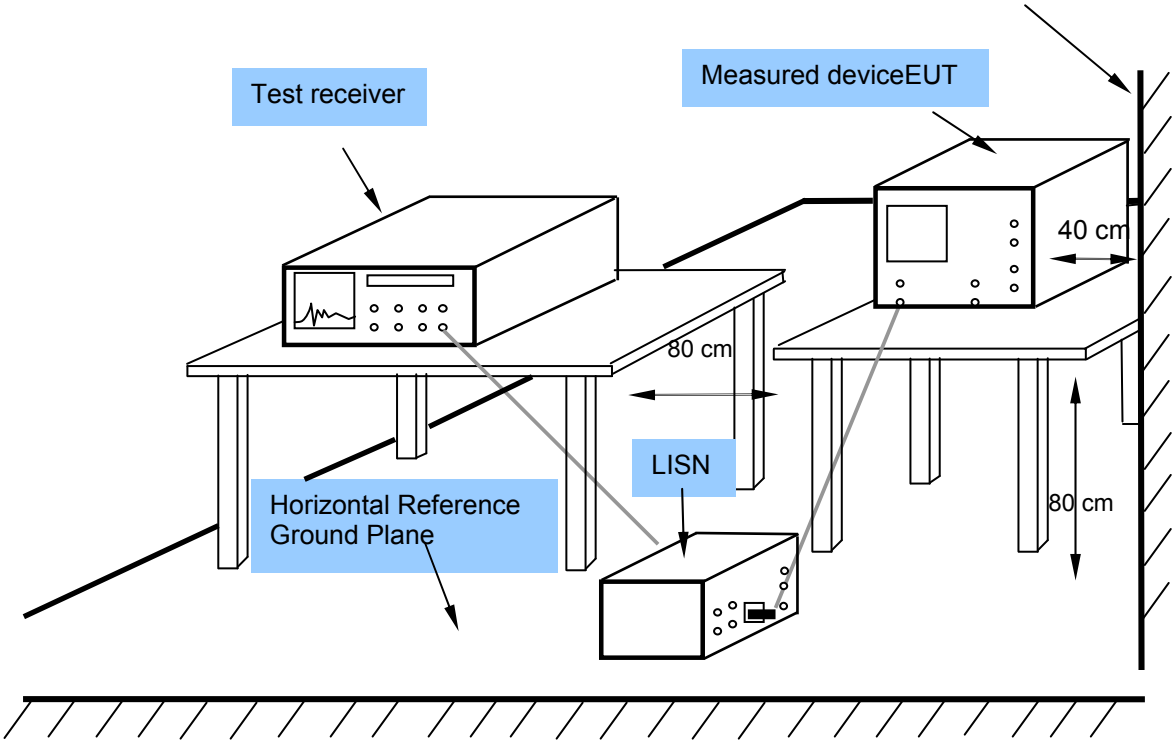
Test instruments

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESU26	100428	2014-01	2016-01	24 months	X
Rohde & Schwarz, Artificial main network	ENV216	101194	2014-008	2016-08	24 months	X

Test procedure

- The EUT is placed on a non-conductive 0.8 meters high table, 0.4 meters from the vertical conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). LISN provide 50 Ohm / 50 μH + 5 Ohm of coupling impedance for the measuring instrument.
- Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
- AC power lines of EUT are checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz is searched using PEAK, QUASI-PEAK and AVERAGE function of the receiver. Bandwidth is set to 9 kHz.
- Test is performed with the RFID antenna connected to determine compliance outside the transmitter's fundamental emission band.
- Retest with a dummy load in lieu of the antenna to determine compliance within the transmitter's fundamental emission band.

Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

Test results:
Device passed the requirements stated in FCC part 15, Subpart C, Section 15.207

Conducted emission measurements with RFID antenna connected:

ROHDE&SCHWARZ

16.Feb 16 14:18

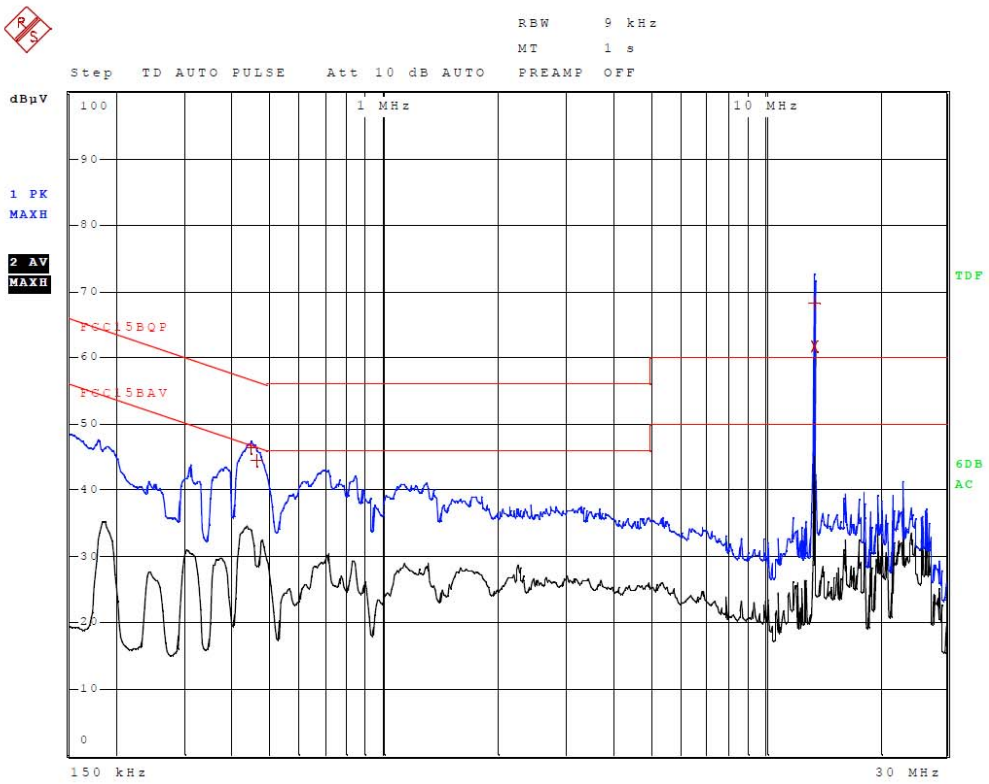
Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz
Operator	ANDREJ SKOF

Test Spec
PHASE

Time Domain Scan (1 Range)

Scan Start: 150 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK Trace 2: Average
Transducer: ENV216

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

16.Feb 16 14:18

Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz
Operator	ANDREJ SKOF

Test Spec
PHASE

Final Measurement

Meas Time: 1 s
Margin: 10 dB
Subranges: 4

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	13.560000000 MHz	61.72	CISPR Averag	11.72
1	13.560000000 MHz	68.11	Quasi Peak	8.11
1	444.750000000 kHz	46.25	Quasi Peak	-10.72
1	460.500000000 kHz	44.50	Quasi Peak	-12.18

ROHDE&SCHWARZ

16.Feb 16 14:17

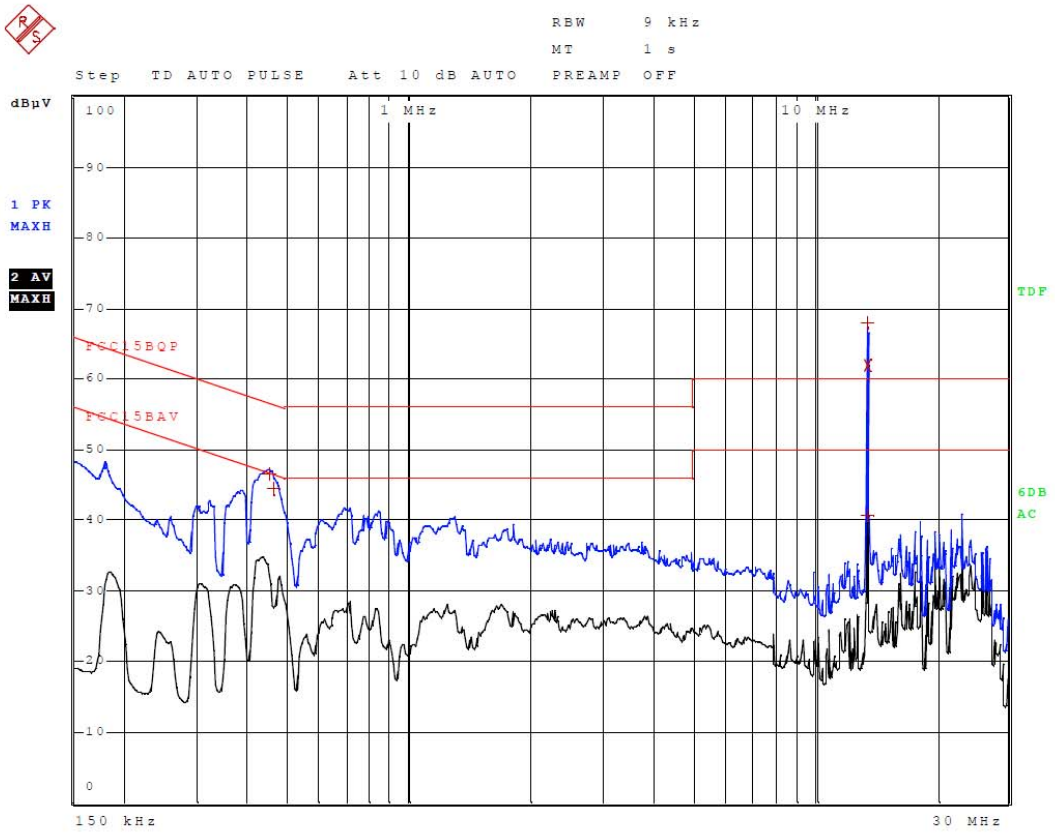
Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz
Operator	ANDREJ SKOF

Test Spec
NEUTRAL

Time Domain Scan (1 Range)

Scan Start: 150 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK Trace 2: Average
Transducer: ENV216

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

16.Feb 16 14:17

Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz
Operator	ANDREJ SKOF

Test Spec
NEUTRAL

Final Measurement

Meas Time: 1 s
Margin: 10 dB
Subranges: 5

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	13.560000000 MHz	61.78	CISPR Averag	11.78
1	13.560000000 MHz	68.06	Quasi Peak	8.06
1	451.500000000 kHz	46.52	Quasi Peak	-10.33
1	460.500000000 kHz	44.46	Quasi Peak	-12.22
1	13.548750000 MHz	40.70	Quasi Peak	-19.30

Conducted emission measurements with a dummy load in lieu of the antenna:

ROHDE&SCHWARZ

30.Sep 16 13:46

Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz, with dummy load
Operator	Andrej Skof

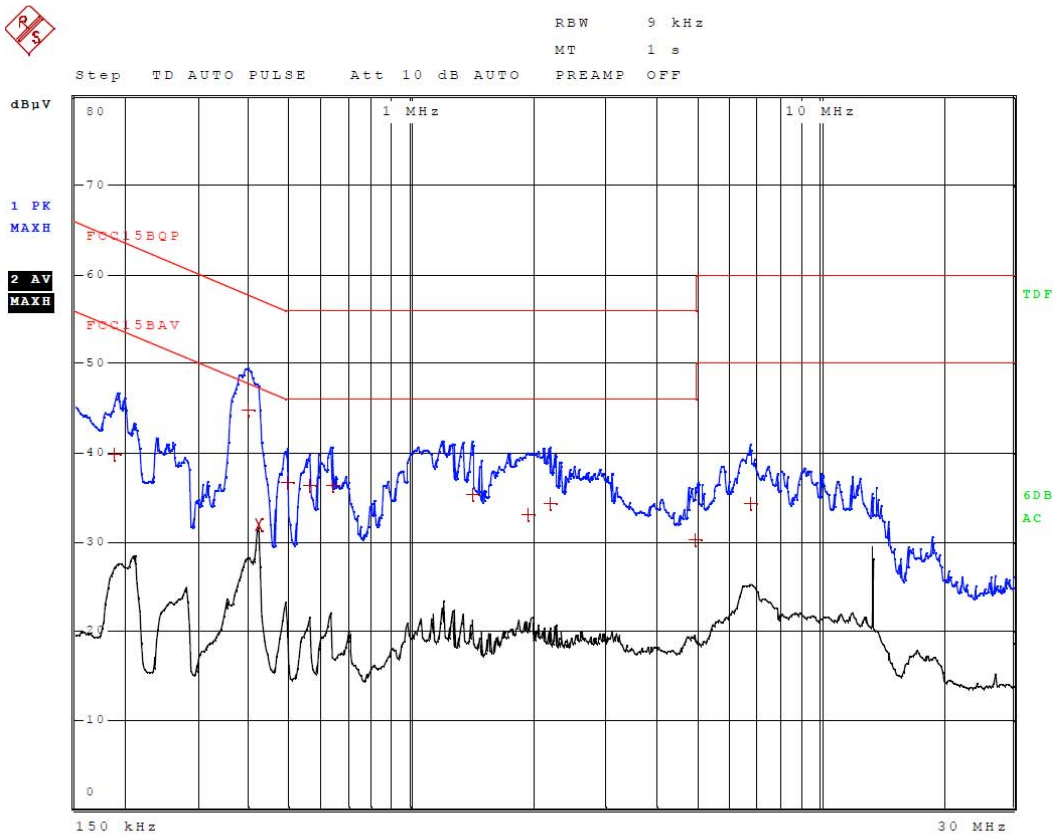
Test Spec

PHASE

Time Domain Scan (1 Range)

Scan Start: 150 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK Trace 2: Average
Transducer: ENV216

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

30.Sep 16 13:46

Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz, with dummy load
Operator	Andrej Skof

Test Spec
PHASE

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Peaks: 11

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	397.500000000 kHz	44.80	Quasi Peak	-13.10
2	420.000000000 kHz	31.89	CISPR Averag	-15.56
1	494.250000000 kHz	36.61	Quasi Peak	-19.48
1	636.000000000 kHz	36.22	Quasi Peak	-19.78
1	564.000000000 kHz	36.18	Quasi Peak	-19.82
1	1.414500000 MHz	35.28	Quasi Peak	-20.72
1	2.184000000 MHz	34.24	Quasi Peak	-21.76
1	1.923000000 MHz	33.09	Quasi Peak	-22.91
1	188.250000000 kHz	39.81	Quasi Peak	-24.30
1	4.951500000 MHz	30.19	Quasi Peak	-25.81
1	6.792000000 MHz	34.17	Quasi Peak	-25.83

ROHDE&SCHWARZ

30.Sep 16 13:48

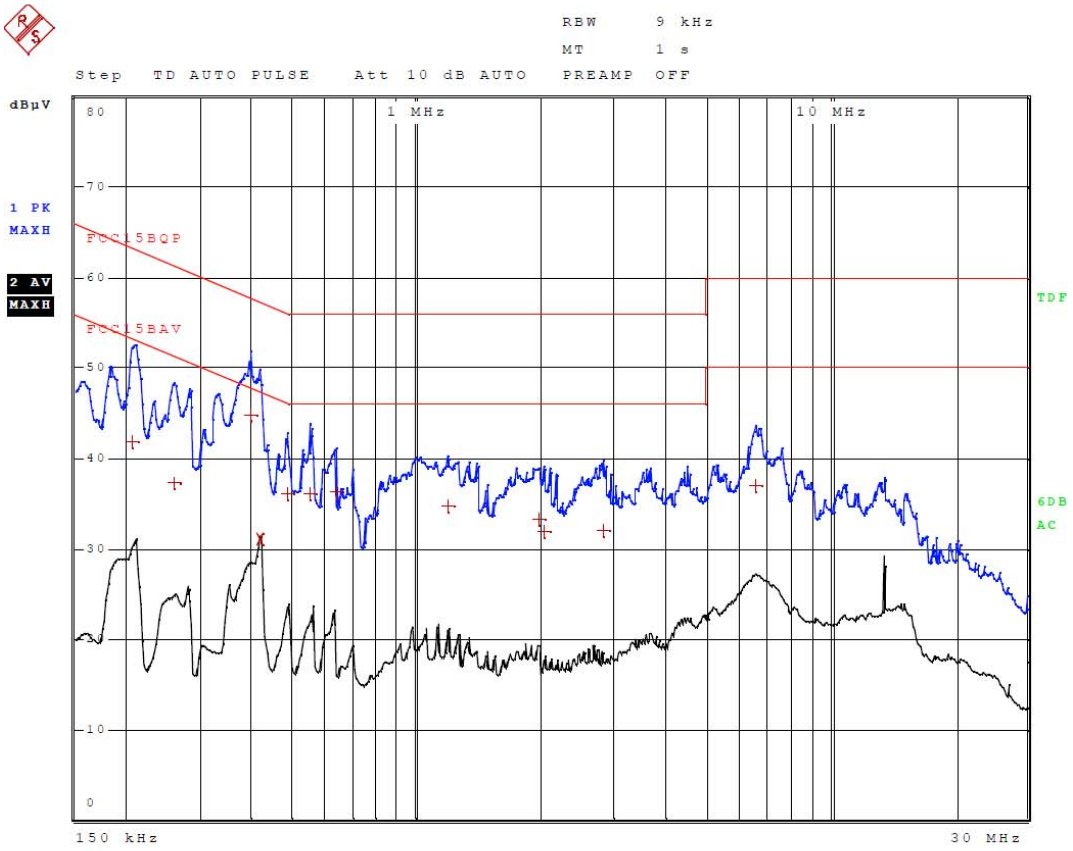
Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz, with dummy load
Operator	Andrej Skof

Test Spec
NEUTRAL

Time Domain Scan (1 Range)

Scan Start: 150 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK Trace 2: Average
Transducer: ENV216

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

30.Sep 16 13:48

Meas Type	CONDUCTED EMISSION
Equipment under Test	Metra Reader Module RFID ISO
Manufacturer	METRA INZENIRING d.o.o.
OP Condition	Uin: 120 V, 60 Hz, with dummy load
Operator	Andrej Skof

Test Spec
NEUTRAL

Final Measurement

Meas Time:	1 s
Margin:	20 dB
Peaks:	12

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	395.250000000 kHz	44.85	Quasi Peak	-13.10
2	417.750000000 kHz	31.01	CISPR Averag	-16.48
1	636.000000000 kHz	36.27	Quasi Peak	-19.73
1	552.750000000 kHz	36.05	Quasi Peak	-19.95
1	485.250000000 kHz	36.12	Quasi Peak	-20.13
1	1.189500000 MHz	34.71	Quasi Peak	-21.29
1	206.250000000 kHz	41.82	Quasi Peak	-21.54
1	1.972500000 MHz	33.12	Quasi Peak	-22.88
1	6.641250000 MHz	36.89	Quasi Peak	-23.11
1	2.818500000 MHz	32.09	Quasi Peak	-23.91
1	2.031000000 MHz	31.78	Quasi Peak	-24.22
1	258.000000000 kHz	37.18	Quasi Peak	-24.32

7.2 Radiated emission measurement from 9 kHz to 1 GHz (15.209)

Test instruments

Description & Manufacturer	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
ETS, Anechoic chamber	3m	103949	2014-11	2016-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU8	105187	2015-11	2017-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU26	100428	2016-02	2018-02	24 months	/
R&S, Antenna	HFH2-Z2	/	2015-09	2017-09	24 months	X
EMCO, Antenna	3142B	104351	2015-09	2017-09	24 months	X
EMCO, Antenna	3115	103002	2015-09	2017-09	24 months	/
Heinrich Deisel, Turn table	DS 420.00	103337	NA	NA	NA	X
Antenna tower	/	/	NA	NA	NA	X
Controller for turn table and antenna tower	/	/	NA	NA	NA	X

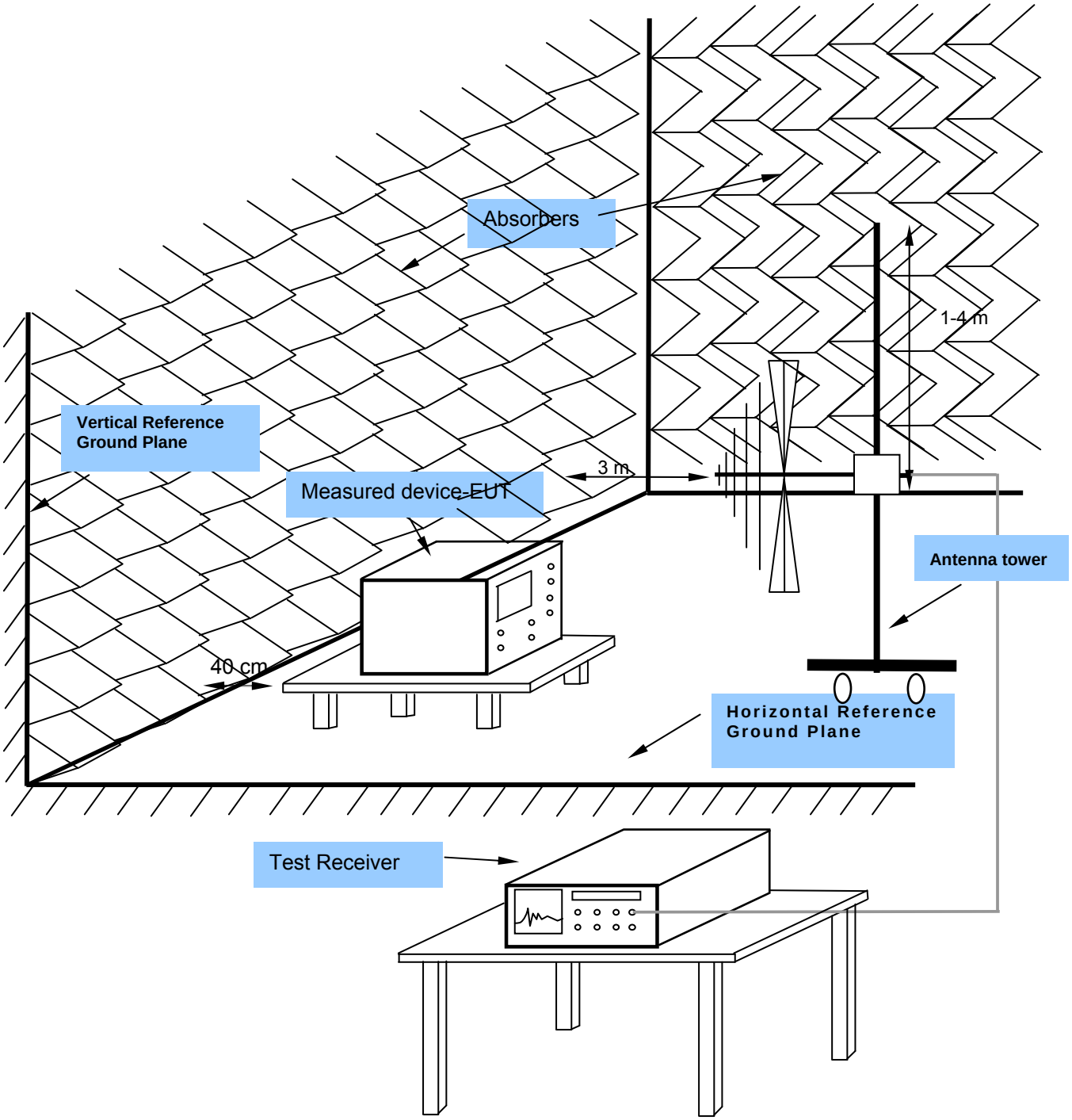
Test procedure for measurements from 9 kHz to 30 MHz

1. Radiated emission in the frequency range 9 kHz to 30 MHz was measured using an active loop antenna.
2. Preliminary the whole spectrum of emission caused by the equipment was recorded at a distance of 3 meters in semi-anechoic room.
3. EUT was rotated all around to find the maximum levels of emissions. Equipment and cables were placed to find their maximum emissions.
4. Final measurement was performed at a distance of 30 m using an Open Field Test Site. In case the regulation requires testing at other distances, the result was extrapolated by either making measurements at an additional distance of 10 m to determine the proper extrapolation factor or by using the square of a linear inverse linear distance extrapolation factor (40 dB/decade). In case of low emissions measurements were performed at shorter distances and results extrapolated to the required distance. The provisions of 15.31(d) and 15.31(f)(2) apply.
5. According to 15.209(d) final measurement was performed with the test-receiver system function set to Quasi-Peak Detect Function, except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where, for non-pulsed operation, Average Detector was employed.

Test procedure for measurements from 30 MHz to 1 GHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak and Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The highest points would be re-tested one by one using the quasi-peak method.

Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

Test results
Device passed the requirements stated in FCC Part 15, Subpart C, Section 15.209

ROHDE&SCHWARZ

C20160123

22.Feb 16 08:28

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING CARD
Operator	Andrej Skof

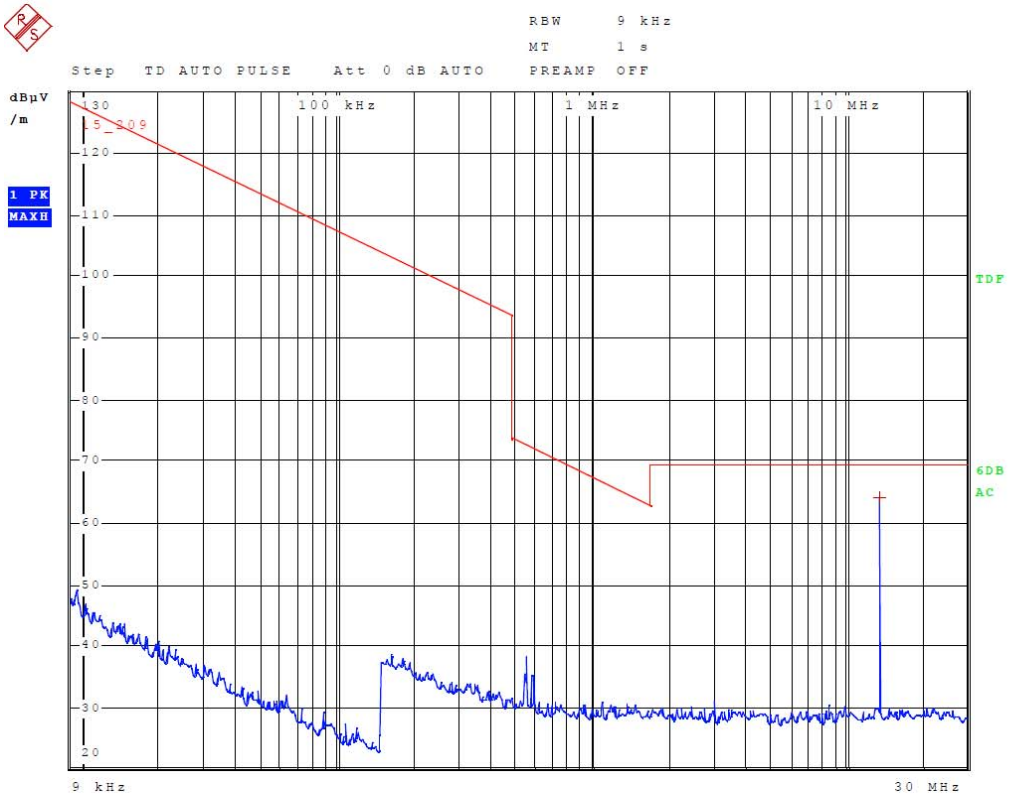
Test Spec

Antenna: 20 deg, Sample: 340 deg

Time Domain Scan (2 Ranges)

Scan Start: 9 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK
Transducer: HFH2-Z2V

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
9.000000 kHz	149.950000 kHz	50.00 Hz	200.00 Hz	300 ms	Auto	0 dB	INPUT2
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

C20160123

22.Feb 16 08:28

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING CARD
Operator	Andrej Skof

Test Spec
Antenna: 20 deg, Sample: 340 deg

Final Measurement

Meas Time:	1 s
Margin:	15 dB
Subranges:	1

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	13.560000000 MHz	63.91	Quasi Peak	-5.59

ROHDE&SCHWARZ

C20160123

22.Feb 16 08:27

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

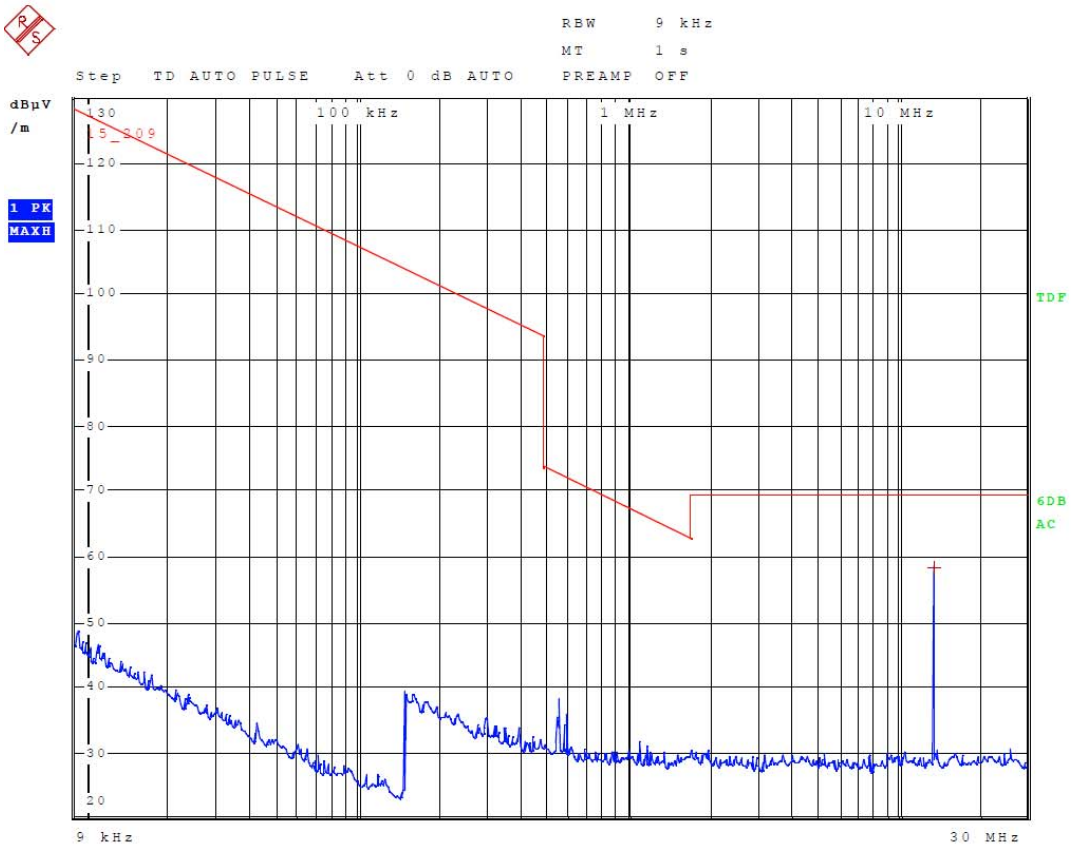
Test Spec

Antenna: 20 deg, Sample: 340 deg

Time Domain Scan (2 Ranges)

Scan Start: 9 kHz
Scan Stop: 30 MHz
Detector: Trace 1: MAX PEAK
Transducer: HFH2-Z2V

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
9.000000 kHz	149.950000 kHz	50.00 Hz	200.00 Hz	300 ms	Auto	0 dB	INPUT2
150.000000 kHz	30.000000 MHz	2.25 kHz	9.00 kHz	30 ms	Auto	0 dB	INPUT2



ROHDE&SCHWARZ

C20160123

22.Feb 16 08:27

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

Test Spec
Antenna: 20 deg, Sample: 340 deg

Final Measurement

Meas Time:	1 s
Margin:	15 dB
Subranges:	1

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	13.560000000 MHz	58.16	Quasi Peak	-11.34

Final Radiated emission measurements from 9 kHZ to 30 MHz at 10 m in OATS

Results with measuring distance of 10 m				
Mode	**Frequency (MHz)**	**Measured value (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**
Reading a card	13.56	43.87	104.00	60.13
Waiting for a card	13.56	46.61	104.00	57.39

Calculated value from 10 m to 30 m						
Mode	**Frequency (MHz)**	**Measured value at 10 m (dBµV/m)**	**Correction factor from 10 m to 30 m (dB)**	**Calculated value at 30 m (dBµV/m)**	**Limit at 30 m (dBµV/m)**	**Margin (dB)**
Reading a card	13.56	43.87	20	23.87	84.00	60.13
Waiting for a card	13.56	46.61	20	26.61	84.00	57.39

NOTE: Antenna factor and cable loss are already included in measurement correction.

ROHDE&SCHWARZ

C20160123

22.Feb 16 07:23

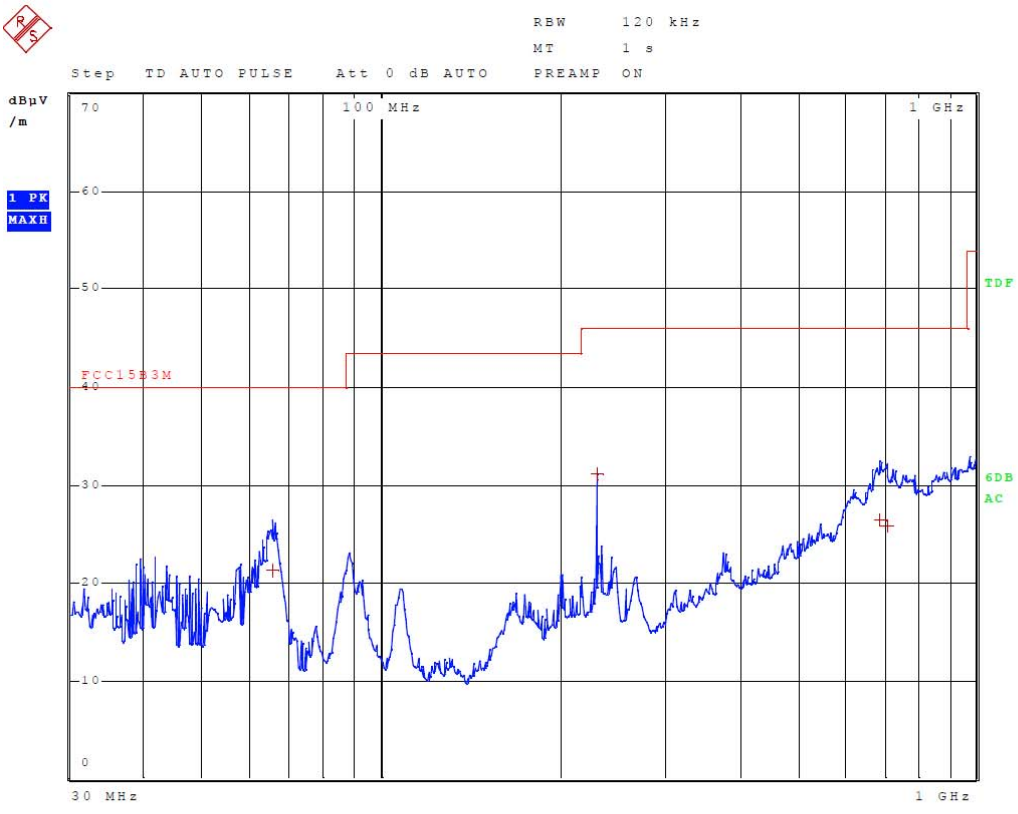
Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING A CARD
Operator	Andrej Skof

Test Spec
VERTICAL 100 cm, 285 deg

Time Domain Scan (1 Range)

Scan Start: 30 MHz
Scan Stop: 1 GHz
Detector: Trace 1: MAX PEAK
Transducer: 3142B3m

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
30.000000 MHz	1.000000 GHz	30.00 kHz	120.00 kHz	2 ms	Auto	20 dB	INPUT2



ROHDE&SCHWARZ

C20160123

22.Feb 16 07:23

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING A CARD
Operator	Andrej Skof

Test Spec
VERTICAL 100 cm, 285 deg

Final Measurement

Meas Time:	1 s
Margin:	15 dB
Subranges:	4

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	230.520000000 MHz	31.13	Quasi Peak	-14.87
1	65.640000000 MHz	21.31	Quasi Peak	-18.69
1	690.120000000 MHz	26.45	Quasi Peak	-19.55
1	710.670000000 MHz	25.77	Quasi Peak	-20.23

NOTE: Antenna factor and cable loss are already included in measurement correction.

ROHDE&SCHWARZ

C20160123

22.Feb 16 07:20

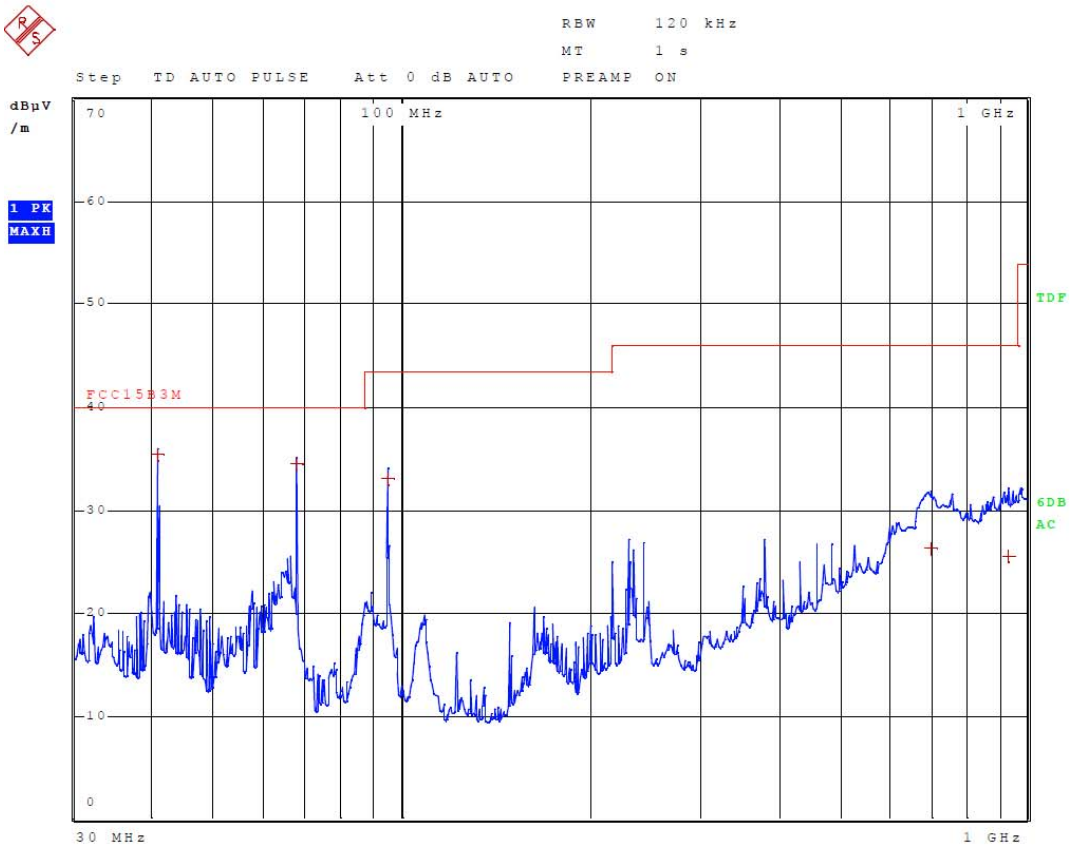
Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

Test Spec
VERTICAL 100 cm, 285 deg

Time Domain Scan (1 Range)

Scan Start: 30 MHz
Scan Stop: 1 GHz
Detector: Trace 1: MAX PEAK
Transducer: 3142B3m

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
30.000000 MHz	1.000000 GHz	30.00 kHz	120.00 kHz	2 ms	Auto	20 dB	INPUT2



ROHDE&SCHWARZ

C20160123

22.Feb 16 07:20

Meas Type	RADIATED EMISSION
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

Test Spec
VERTICAL 100 cm, 285 deg

Final Measurement

Meas Time: 1 s
Margin: 15 dB
Subranges: 5

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	40.680000000 MHz	35.35	Quasi Peak	-4.65
1	67.800000000 MHz	34.53	Quasi Peak	-5.47
1	94.920000000 MHz	33.05	Quasi Peak	-10.45
1	703.680000000 MHz	26.29	Quasi Peak	-19.71
1	932.160000000 MHz	25.44	Quasi Peak	-20.56

NOTE: Antenna factor and cable loss are already included in measurement correction.

7.3 Bandwidth of the emission (15.215)

Section 15.215 Additional provisions to the general radiated emission limitations

Test instruments

Description & Manufacturer	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
ETS, Anechoic chamber	3m	103949	2014-11	2016-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU8	105187	2015-11	2017-11	24 months	X
EMCO, Antenna	3142B	06/068	2015-09	2017-09	24 months	
Rohde & Schwarz, Active loop antenna	HFH2-Z2	/	2015-09	2017-09	24 months	X
Heinrich Deisel, Turn table	DS 420.00	103337	NA	NA	NA	X
ETS, Antenna tower	/	/	NA	NA	NA	X
ETS, Controller for turn table and antenna tower	/	/	NA	NA	NA	X

Test procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 m away from the interference-receiving antenna.
3. Resolution bandwidth is set to a value greater than 5% of the allowed bandwidth. If no bandwidth specifications are given, the guidelines in Section 1.4 are used

Test results
Device passed the requirements stated in FCC Part 15, Subpart C, Section 15.215

ROHDE&SCHWARZ

C20160123

22.Feb 16 08:38

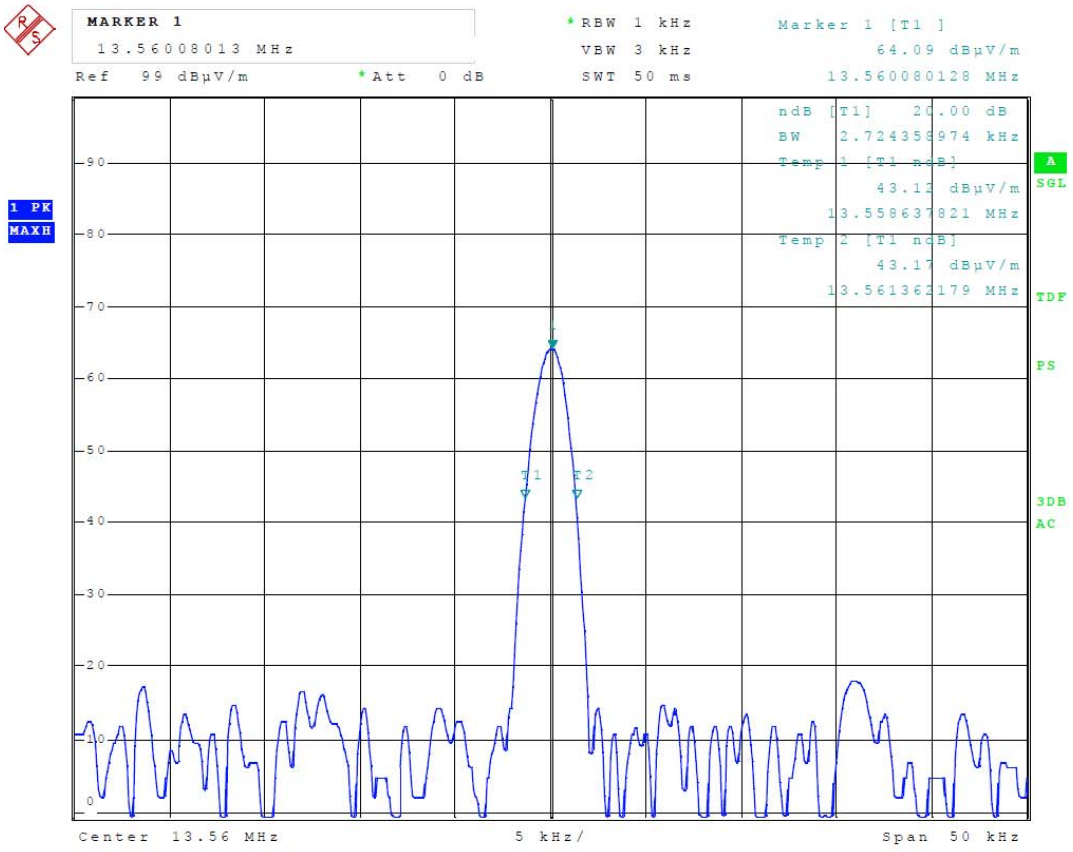
Meas Type	OCCUPIED BANDWIDTH
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING A CARD
Operator	Andrej Skof

Test Spec

Antenna: 20 deg, Sample: 340 deg

Sweep Settings Screen A

Center Frequency	13.560000 MHz	Ref Level	99.000 dBµV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	50.000000 kHz	Ref Position	100.000 %
Start Frequency	13.535000 MHz	Level Range	100.000 dB
Stop Frequency	13.585000 MHz	RF Att	0.000 dB
RBW	1.000000 kHz		
VBW	3.000000 kHz	X-Axis	LIN
Sweep Time	50.00 ms	Y-Axis	LOG



ROHDE&SCHWARZ

C20160123

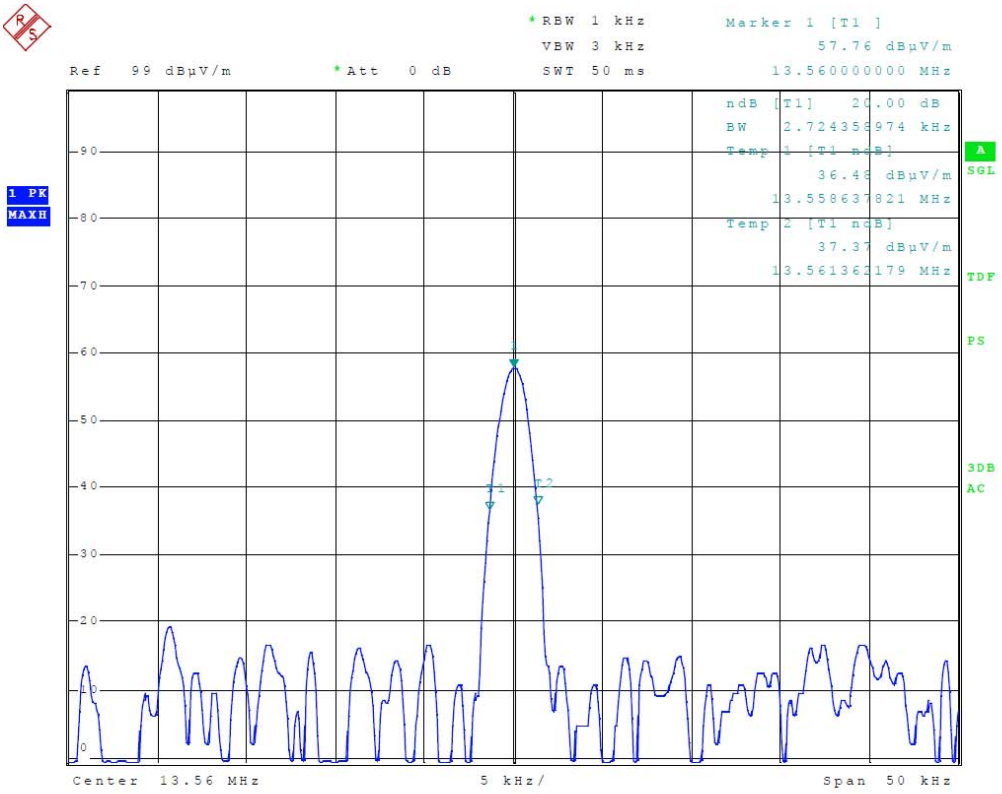
22.Feb 16 08:37

Meas Type	OCCUPIED BANDWIDTH
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

Test Spec
Antenna: 20 deg, Sample: 340 deg

Sweep Settings Screen A

Center Frequency	13.560000 MHz	Ref Level	99.000 dBµV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	50.000000 kHz	Ref Position	100.000 %
Start Frequency	13.535000 MHz	Level Range	100.000 dB
Stop Frequency	13.585000 MHz	RF Att	0.000 dB
RBW	1.000000 kHz		
VBW	3.000000 kHz	X-Axis	LIN
Sweep Time	50.00 ms	Y-Axis	LOG



Page 1 of 1

Frequency (MHz)	Permitted frequency band (MHz)	20 dB bandwidth (kHz)	PASS/FAIL
13.56	13.110 – 14.010	2.72	PASS

7.4 Spectrum mask (15.225)

Section 15.225 Operation within the band 13.110 – 14.010 MHz – clause a – clause d

Test instruments

Description & Manufacturer	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
ETS, Anechoic chamber	3m	103949	2014-11	2016-11	24 months	X
Rohde-Schwarz, RFI receiver	ESU26	106897	2015-12	2017-12	24 months	X
EMCO, Antenna	3142B	06/068	2015-09	2017-09	24 months	
Rohde & Schwarz, Active loop antenna	HFH2-Z2	/	2015-09	2017-09	24 months	X
Heinrich Deisel, Turn table	DS 420.00	103337	NA	NA	NA	X
ETS, Antenna tower	/	/	NA	NA	NA	X
ETS, Controller for turn table and antenna tower	/	/	NA	NA	NA	X

Test procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 m away from the interference-receiving antenna.
3. Frequencies with maximum emission were retested on OATS.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

Test results

Device passed the requirements stated in FCC Part 15, Subpart C, Section 15.225

ROHDE&SCHWARZ

C20160123

22.Feb 16 08:32

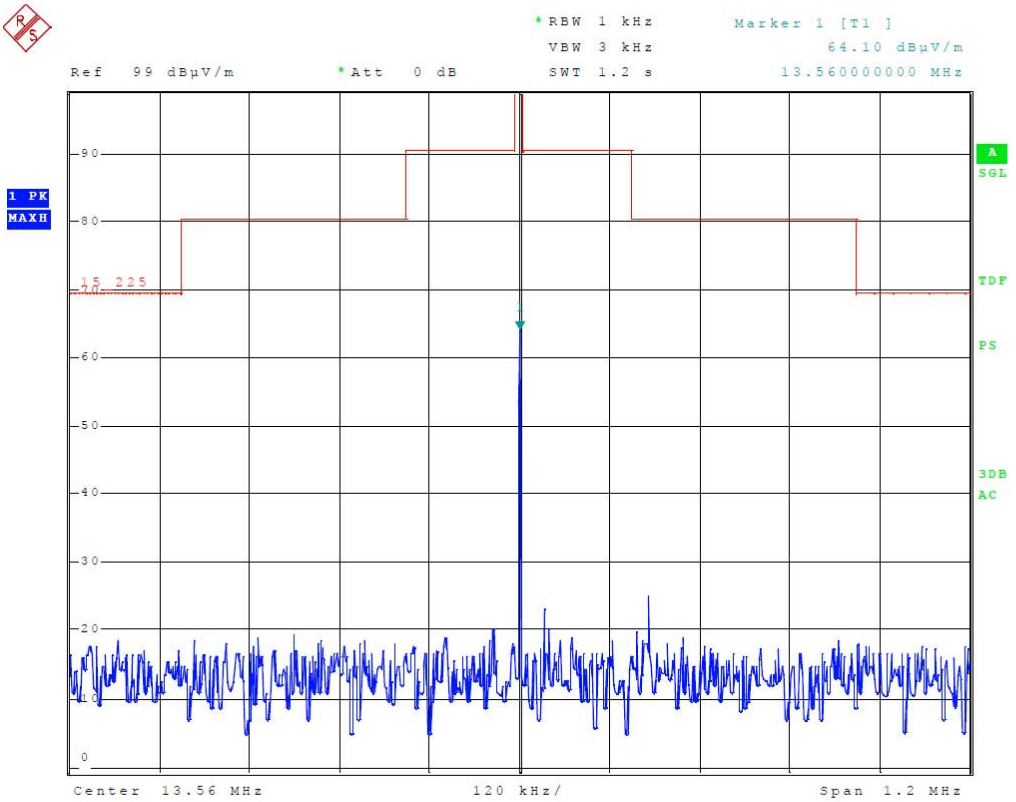
Meas Type	SPECTRUM MASK
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	WAITING CARD
Operator	Andrej Skof

Test Spec

Antenna: 20 deg, Sample: 340 deg

Sweep Settings **Screen A**

Center Frequency	13.560000 MHz	Ref Level	99.000 dBµV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	1.200000 MHz	Ref Position	100.000 %
Start Frequency	12.960000 MHz	Level Range	100.000 dB
Stop Frequency	14.160000 MHz	RF Att	0.000 dB
RBW	1.000000 kHz		
VBW	3.000000 kHz	X-Axis	LIN
Sweep Time	1.20 s	Y-Axis	LOG



ROHDE&SCHWARZ

C20160123

22.Feb 16 08:33

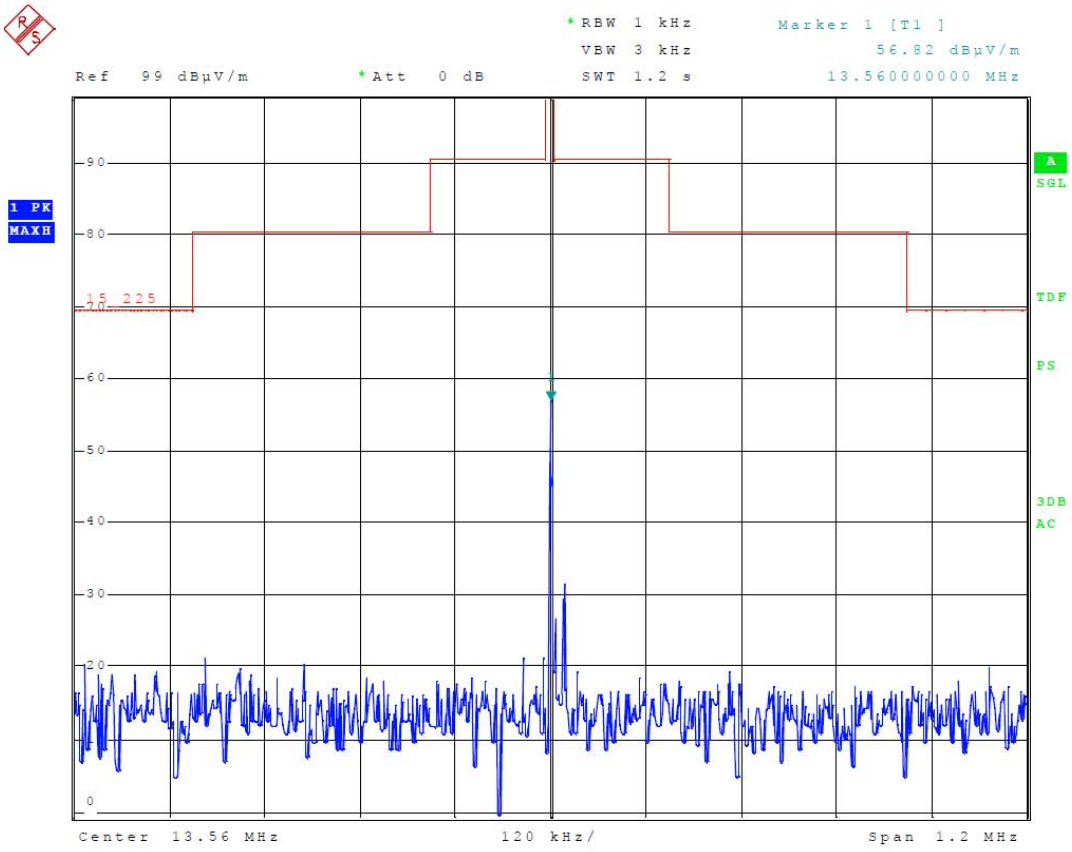
Meas Type	SPECTRUM MASK
Equipment under Test	METRA READER MODULE RFID ISO
Manufacturer	METRA INZENIRING D.O.O.
OP Condition	READING A CARD
Operator	Andrej Skof

Test Spec

Antenna: 20 deg, Sample: 340 deg

Sweep Settings Screen A

Center Frequency	13.560000 MHz	Ref Level	99.000 dBµV/m
Frequency Offset	0.000000 Hz	Ref Level Offset	0.000 dB
Span	1.200000 MHz	Ref Position	100.000 %
Start Frequency	12.960000 MHz	Level Range	100.000 dB
Stop Frequency	14.160000 MHz	RF Att	0.000 dB
RBW	1.000000 kHz		
VBW	3.000000 kHz	X-Axis	LIN
Sweep Time	1.20 s	Y-Axis	LOG



7.5 Frequency tolerance of the carrier signal

Section 15.225 Operation within the band 13.110 – 14.010 MHz

Test instruments:

Description & Manufacturer	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESU8	105187	2015-11	2017-11	24 months	X
Rohde & Schwarz, Active loop antenna	HFH2-Z2	/	2015-09	2017-09	24 months	X
Fluke, Digital Multimeter	179	106728	2015-07	2016-07	12 months	X
Kambič, Temperature chamber	I-190 CK	107298	Na	Na	/	X

Test requirements:

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees 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 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test results
Device passed the requirements stated in FCC Part 15, Subpart C, Section 15.225

Temperature	Supply voltage (V)	Minutes after switch on	Measured Frequency (MHz)	Allowed tolerance	Measured tolerance	RESULT
50	12,00	0	13,559953513	Fref±1.356 kHz	-0,066	PASS
	12,00	2	13,559948705	Fref±1.356 kHz	-0,071	PASS
	12,00	5	13,559947103	Fref±1.356 kHz	-0,072	PASS
	12,00	10	13,559945500	Fref±1.356 kHz	-0,074	PASS
40	12,00	0	13,559974346	Fref±1.356 kHz	-0,045	PASS
	12,00	2	13,559969538	Fref±1.356 kHz	-0,050	PASS
	12,00	5	13,559966333	Fref±1.356 kHz	-0,053	PASS
	12,00	10	13,559964731	Fref±1.356 kHz	-0,054	PASS
30	12,00	0	13,560009603	Fref±1.356 kHz	-0,010	PASS
	12,00	2	13,560003192	Fref±1.356 kHz	-0,016	PASS
	12,00	5	13,559999987	Fref±1.356 kHz	-0,019	PASS
	12,00	10	13,559996782	Fref±1.356 kHz	-0,022	PASS
20	10,20	0	13,560016013	Fref±1.356 kHz	-0,003	PASS
	10,20	2	13,560019218	Fref±1.356 kHz	0,000	PASS
	10,20	5	13,560017615	Fref±1.356 kHz	-0,002	PASS
	10,20	10	13,560019218	Fref±1.356 kHz	0,000	PASS
20	12,00	0	13,560017615	Fref±1.356 kHz	-0,002	PASS
	12,00	2	13,560019218	Fref±1.356 kHz	0,000	PASS
	12,00	5	13,560019218	Fref±1.356 kHz	0,000	PASS
	12,00	**10**	**13,560019218**	**Fref**	0,000	
20	13,80	0	13,560019218	Fref±1.356 kHz	0,000	PASS
	13,80	2	13,560017615	Fref±1.356 kHz	-0,002	PASS
	13,80	5	13,560019218	Fref±1.356 kHz	0,000	PASS
	13,80	10	13,560019218	Fref±1.356 kHz	0,000	PASS
10	12,00	0	13,559995192	Fref±1.356 kHz	-0,024	PASS
	12,00	2	13,560003205	Fref±1.356 kHz	-0,016	PASS
	12,00	5	13,560003205	Fref±1.356 kHz	-0,016	PASS
	12,00	10	13,560004808	Fref±1.356 kHz	-0,014	PASS
0	12,00	0	13,559995192	Fref±1.356 kHz	-0,024	PASS
	12,00	2	13,559971154	Fref±1.356 kHz	-0,048	PASS
	12,00	5	13,559971154	Fref±1.356 kHz	-0,048	PASS
	12,00	10	13,559972756	Fref±1.356 kHz	-0,046	PASS
-10	12,00	0	13,559842949	Fref±1.356 kHz	-0,176	PASS
	12,00	2	13,559876603	Fref±1.356 kHz	-0,143	PASS
	12,00	5	13,559878205	Fref±1.356 kHz	-0,141	PASS
	12,00	10	13,559879808	Fref±1.356 kHz	-0,139	PASS
-20	12,00	0	13,559732372	Fref±1.356 kHz	-0,287	PASS
	12,00	2	13,559774404	Fref±1.356 kHz	-0,245	PASS
	12,00	5	13,559782051	Fref±1.356 kHz	-0,237	PASS
	12,00	10	13,559794872	Fref±1.356 kHz	-0,224	PASS