Prüfbericht - Produkte *Test Report - Products*



Prüfbericht-Nr.: Test report no.:	60409345 001		Auftrags-Nr.: Order no.:	238487137	Seite 1 von 22 Page 1 of 22
Kunden-Referenz-Nr.: Client reference no.:	N/A		Auftragsdatum: Order date:	29-May-2020	
Auftraggeber: Client:		Industrea Mining Technology Pty Ltd 3 Co-Wyn Close, Fountaindale, NSW, 2258, Australia			
Prüfgegenstand: Test item:	Personal Digita	al Assistant			
Bezeichnung / Typ-Nr.: Identification / Type no.:	PROD1185				
Auftrags-Inhalt: Order content:	FCC Part 15C	Test report (R	FID)		
Prüfgrundlage: Test specification:	FCC 47CFR P	art 15: Subpar	rt C Section 15.225		
Wareneingangsdatum: Date of sample receipt:	14-Jul-2020				
Prüfmuster-Nr.: Test sample no:	A002866252-0)09			
Prüfzeitraum: Testing period:	7-Aug-2020 ~	10-Aug-2020			
Ort der Prüfung: Place of testing:	EMC/RF Labo	ratory Taipei			
Prüflaboratorium: Testing laboratory:	Taipei Testing	Laboratories			
Prüfergebnis*: Test result*:	Pass				
überprüft von: reviewed by:			genehmigt von authorized by:	Brenda	CL
Datum: 25-Aug-2020 Date:	Ryan W.T.	Chen	Datum: 25-Aug-20 Date:		S.H. Chen
Stellung / Position:	Project Mar		Stellung / Position		Manager
Sonstiges / Other:					
Zustand des Prüfgegenstandes bei Anlieferung:Prüfmuster vollständig und unbeschädigtCondition of the test item at delivery:Test item complete and undamaged					
	2 = gut	3 = befriedigend F(ail) = entspricht r	nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
* Legend: 1 = very good P(ass) = passed a.m	2 = good . test specification(s)	3 = satisfactory F(ail) = failed a.m.	test specification(s)	4 = sufficient N/A = not applicable	5 = poor N/T = not tested
Dieser Prüfbericht bezi auszugsweise vervie	ieht sich nur auf	das o.g. Prüfm	uster und darf ohne C	Genehmigung der Pri	
This test report only relates to	o the a. m. test sar	mple. Without pe		enter this test report is	



Products

Prüfbericht - Nr.: Test Report No.

60409345 001

Seite 2 von 22 Page 2 of 22

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.203	Antenna Requirement	Pass
5.1.2	15.225 (a)(b)(c)	Field Strength of Fundamental Emissions	Pass
5.1.3	15.225 (d)	Radiated Spurious Emissions	Pass
5.1.4	15.225 (e)	Frequency Stability	Pass
5.1.5	15.215 (c)	20 dB Bandwidth	Pass
-	15.207	Mains Conducted Emission	N/A

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.



Prüfbericht - Nr.: 60409345 001 Seite 3 von 22 Page 3 of 22 Test Report No. Contents 1. 1.1 1.2 2. 2.1 2.2 2.3 2.4 2.5 MEASUREMENT UNCERTAINTY7 3. PRODUCT FUNCTION AND INTENDED USE8 3.1 SYSTEM DETAILS AND RATINGS......8 3.2 3.3 3.4 4. TEST SET-UP AND OPERATION MODES......10 4.1 PRINCIPLE OF CONFIGURATION SELECTION10 4.2 TEST OPERATION AND TEST SOFTWARE......10 4.3 4.4 5. TRANSMITTER REQUIREMENT & TEST SUITES12 5.1 5.1.1 5.1.2 5.1.3 5.1.4 5.1.5 **APPENDIX A - TEST RESULT OF RADIATED SPURIOUS EMISSIONS** APPENDIX SP - PHOTOGRAPHS OF TEST SETUP APPENDIX EP - PHOTOGRAPHS OF EUT



Produkte	
Products	

Test Report No.

Prüfbericht - Nr.: 60409345 001

Seite 4 von 22 Page 4 of 22

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
60409345 001	Original Release	25-Aug-2020



Prüfbericht - Nr.: Test Report No.

60409345 001

Seite 5 von 22 Page 5 of 22

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix: **Appendix A - Test Result of Radiated Spurious Emissions Appendix SP - Photographs of Test Setup Appendix EP - Photographs of EUT**

Applied Standard and Test Levels

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Radio
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FCC CFR47 Part 15: Subpart C Section 15.225 ANSI C63.10:2013

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.



Produkte Products

> Prüfbericht - Nr.: Test Report No.

60409345 001

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist. Taipei City 105 Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist., New Taipei City 244 Taiwan (R.O.C.) FCC Registration No.: 226631 ISED Registration No.: 25563





aboratol 3567 Seite 6 von 22 Page 6 of 22



Seite 7 von 22 Page 7 of 22

Prüfbericht - Nr.: 60409345 001

Test Report No.

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of k=2 to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.30 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.30 dB
Mains Conducted Emission	± 1.65 dB



Prüfbericht - Nr.: Test Report No.

60409345 001

Seite 8 von 22 Page 8 of 22

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Personal Digital Assistant working at 13.56 MHz with RFID function. For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Personal Digital Assistant
Type Identification	PROD1185
FCC ID	YIY-PROD1185

Technical Specification of EUT

Item	EUT information
Operating Frequency	13.56 MHz
Operation Voltage	5Vdc ~ 9Vdc (Tested at 5Vdc)
Modulation	ASK
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.3

Note:

1. The tested voltage has been evaluated at 5Vdc and 9Vdc and found that 5Vdc is the worst case.



 Prüfbericht - Nr.:
 60409345 001

 Test Report No.
 60409345 001

Seite 9 von 22 Page 9 of 22

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description



Prüfbericht - Nr.: Test Report No.

60409345 001

Seite 10 von 22 Page 10 of 22

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum emission level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: The test sample itself is equipped with a touch screen. It was used to enable the operation modes listed as below.

The samples were used as follows:

A002866252-009

Full test was applied on all test modes, but only worst case was shown.

EUT Configure		Applicable To		
Mode	Radiated Spurious Emissions	Frequency Stability	20 dB Bandwidth	Description
-		\checkmark		-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on Z-plane.

2. "-" means no effect.

Radiated Spurious Emissions

Pre-Scan full test was applied on all test modes, but only worst case was shown.

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode Available Frequency (MHz)		Tested Frequency (MHz)	
- 13.56		13.56	

Frequency Stability

Pre-Scan full test was applied on all test modes, but only worst case was shown.

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)		
- 13.56		13.56		

20 dB Bandwidth

Pre-Scan full test was applied on all test modes, but only worst case was shown.

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	
-	13.56	13.56	

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Radiated Spurious Emissions	22-26 °C	50-65 %	Simon Tsai
Frequency Stability	22-26 °C	50-65 %	Stanislas Charles
20 dB Bandwidth	22-26 °C	50-65 %	Stanislas Charles



Prüfbericht - Nr.: 60409345 001

Seite 11 von 22 Page 11 of 22

Test Report No.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

	Interface Cable								
No.	No. Description Shielded Type Ferrite Core (Qty) Length Remark								
А	Power Cable	YES	0	1.5m					

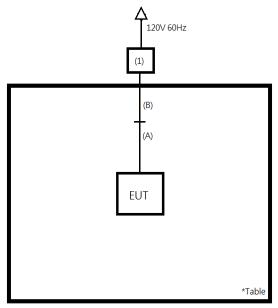
Support Unit

Support Unit								
No. Description Brand Model S/N Ren								
1	Power Supply	KEITHLEY	2303	N/A				

Interface Cable								
No.	No. Description Shielded Type Ferrite Core (Qty) Length Remark							
В	DC Power Cable	NO	0	0.5m				

4.4 Test Setup Diagram

<Radiated Spurious Emissions Tx mode >





Test Report No.

Prüfbericht - Nr.: 60409345 001

Seite 12 von 22 Page 12 of 22

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement

Use of approved antennas only

The antenna is a loop antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision. Since the fundamental frequency is very low, the antenna gain is difficult to measure, therefore, the antenna gain will not be listed within this report.

Refer to EUT photo for details.



Prüfbericht - Nr.: 60409345 001 Test Report No. 60409345 001

Seite 13 von 22 Page 13 of 22

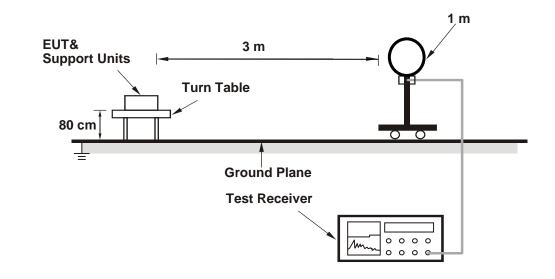
5.1.2 Field Strength of Fundamental Emissions

Limit

- a. The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- b. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- c. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).



Prüfbericht - Nr.:

60409345 001

Seite 14 von 22 Page 14 of 22

Test Report No.

Test Instruments

Kind of	Manufacturer	Туре	S/N	Calibration Date	Calibration Due Date
Equipment Signal Analyzer	R&S	FSV40	101508	2020/3/16	2021/3/15
Receiver	R&S	ESR7	102108	2020/4/22	2021/4/21
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2020/2/14	2021/2/13
Horn Antenna	ETS-Lindgren	3117	00218930	2019/12/6	2020/12/5
LF-AMP	Agilent	8447D	2944A10772	2020/2/11	2021/2/10
HF-AMP + AC source	EMCI	EMC051845SE	980633	2020/2/17	2021/2/16
HF-AMP + AC source	EMCI	EMC184045SE	980657	2020/2/17	2021/2/16
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2020/4/10	2021/4/9
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2020/3/25	2021/3/24
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2020/3/25	2021/3/24
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2020/3/25	2021/3/24
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2020/4/22	2021/4/21
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2020/4/22	2021/4/21
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2020/4/22	2021/4/21
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2020/1/9	2021/1/8



Prüfbericht - Nr.: 60409345 001

Seite 15 von 22 Page 15 of 22

Test Report No.

Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix A.



Seite 16 von 22

Page 16 of 22

Prüfbericht - Nr.: 60409345 001 Test Report No.

5.1.3 Radiated Spurious Emissions

Limit

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209 as below table:

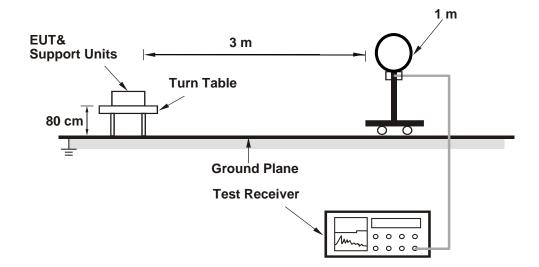
Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Kind of Test Site

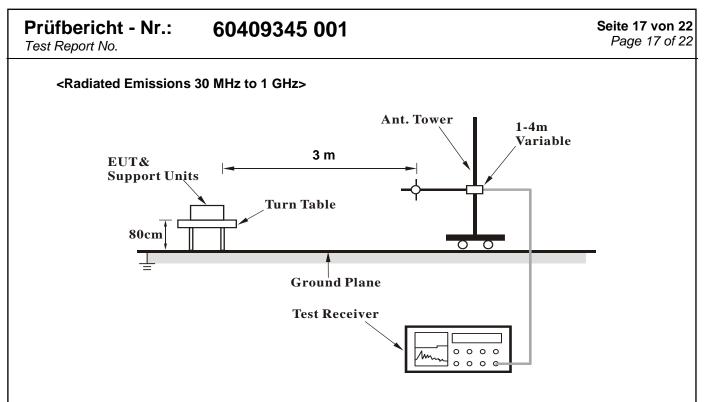
3m Semi-Anechoic Chamber

Test Setup

<Radiated Emissions below 30 MHz>







For the actual test configuration, please refer to the attached file (Test Setup Photo).

Test Instruments

Please refer to 5.1.2 Instruments



Prüfbericht - Nr.: 60409345 001

Seite 18 von 22 Page 18 of 22

Test Report No.

Test Procedures

For Radiated Emissions below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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.
- d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
- 2. All modes of operation were investigated and the worst-case emissions are reported.
- 3. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.



Produkte Products

Prüfbericht - Nr.: 60409345 001

Test Report No.

Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix A.

Seite 19 von 22 Page 19 of 22



Prüfbericht - Nr.: 60409345 001

Seite 20 von 22 Page 20 of 22

Test Report No.

5.1.4 Frequency Stability

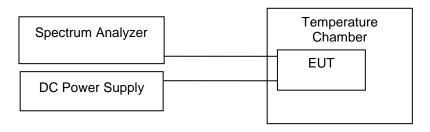
Limit

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.

Kind of Test Site

Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Туре	S/N	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV40	101512	2020/2/18	2021/2/17
Thermal Chamber	Giant Force	GHT-150-40- CP-SD	MAA1902-011	2020/3/10	2021/3/9

Test Procedures

- a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- b. Turned the EUT on and coupled its output to a spectrum analyzer.
- c. Turned the EUT off and set the chamber to the highest temperature specified.
- d. Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- e. Repeated step b and c with the temperature chamber set to the lowest temperature.
- f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85 % to 115 % and the frequency record.



Seite 21 von 22 Page 21 of 22

Prüfbericht - Nr.:

60409345 001

Test Report No.

Test Result

Frequency (MHz)		13.56							
Condition		Test Time				Frequency Error (ppm)			
Extreme	Modulation Mode	0 min	2 min	5 min	10 min	0 min	2 min	5 min	10 min
T _{20°C} V _{max}	CW	13.56062				45.72	/	/	/
T _{20°C} V _{min}	CW	13.56064				47.20			
T _{50°C} V _{nom}	CW	13.56063	13.56062	13.56065	13.56061	46.46	45.72	47.94	44.99
T _{40°C} V _{nom}	CW	13.56062	13.56061	13.56062	13.56063	45.72	44.99	45.72	46.46
T _{30°C} V _{nom}	CW	13.56062	13.56061	13.56065	13.56064	45.72	44.99	47.94	47.20
T _{20°C} V _{nom}	CW	13.56064	13.56064	13.56065	13.56062	47.20	47.20	47.94	45.72
T _{10°C} V _{nom}	CW	13.56065	13.56062	13.56063	13.56062	47.94	45.72	46.46	45.72
T _{0°C} V _{nom}	CW	13.56064	13.56062	13.56063	13.56063	47.20	45.72	46.46	46.46
T-10°CVnom	CW	13.56064	13.56063	13.56061	13.56063	47.20	46.46	44.99	46.46
T-20°CVnom	CW	13.56064	13.56063	13.56065	13.56064	47.20	46.46	47.94	47.20
Limit (ppm)		- 100							
Re	Result		Pass						



Prüfbericht - Nr.: 60409345 001

Test Report No.

5.1.5 20 dB Bandwidth

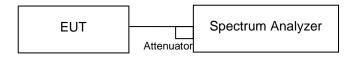
Limit

The 20 dB bandwidth shall be specified in operating frequency band.

Kind of Test Site

Shielded room

Test Setup



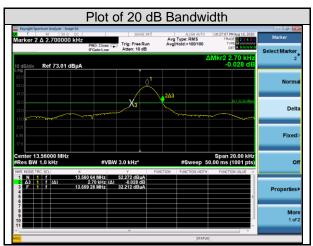
Test Instruments

Kind of Equipment	Manufacturer	Туре	S/N	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV40	101512	2020/2/18	2021/2/17

Test Procedure

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1 kHz RBW and 3 kHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

Test Results



Seite 22 von 22 Page 22 of 22

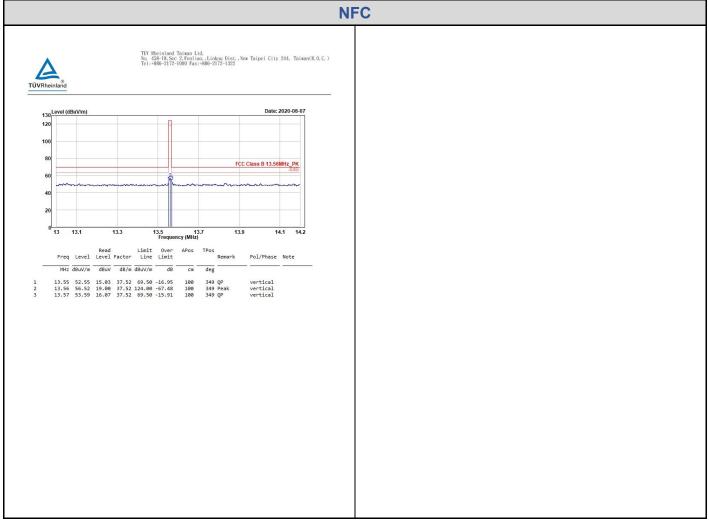


60409345 001

Seite A1 von A3 Page A1 of A3

Appendix A: Test Results of Radiated Spurious Emissions

Fundamental Emissions, 13.553MHz ~ 13.567MHz



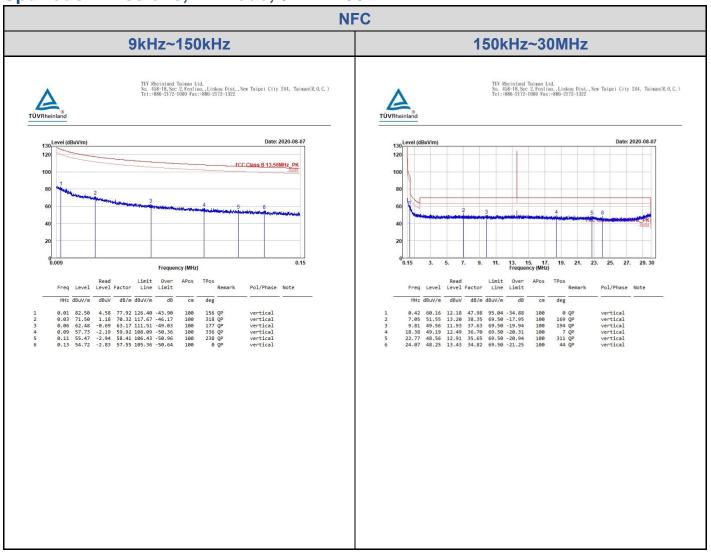
Prüfbericht - Nr.: *Test Report No.*

60409345 001



Seite A2 von A3 Page A2 of A3

Spurious Emissions, Tx Mode, 9kHz ~ 30MHz



Prüfbericht - Nr.:

Test Report No.

60409345 001

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Seite A3 von A3 Page A3 of A3

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

