

Produkte
Products

Prüfbericht - Nr.: 50031017 001		Seite 1 von 30	
<i>Test Report No.:</i>		<i>Page 1 of 30</i>	
Auftraggeber: <i>Client:</i>		New Japan Radio Co., Ltd. 1-1, Fukuoka 2-Chome, Fujimino City Saitama, 356-8510 Japan	
Gegenstand der Prüfung: <i>Test Item:</i>		K-Band Doppler Sensor Module (Movement Sensor)	
Bezeichnung: <i>Identification:</i>		Serien-Nr.: <i>Serial No.:</i>	
NJR4269F3V1, NJR4269F3V2		Refer to Section 4.3	
Wareneingangs-Nr.: <i>Receipt No.:</i>		Eingangsdatum: <i>Date of Receipt:</i>	
A000213070		2015-06-12	
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of Test Item at Delivery:</i> Good			
Prüfort: <i>Testing Location:</i>		TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
Prüfgrundlage: <i>Test Specification:</i>		FCC 47 CFR Part 15, Subpart C, Sections 15.207, 15.209, 15.215 and 15.245 (October 1, 2014) ANSI C63.10-2013	
Prüfergebnis: <i>Test Result:</i> Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>			
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
geprüft/ tested by:		kontrolliert/ reviewed by:	
 2015-07-24 A. Abe / Inspector		 2015-07-24 T. Sauter / Reviewer	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges / Other Aspects:			
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested	
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

Produkte
Products

Prüfbericht - Nr.:**50031017 001****Seite 2 von 30***Test Report No.:**Page 2 of 30*

TEST SUMMARY

5.1.1 SUPPLY VOLTAGE REQUIREMENTS

RESULT: PASS

5.1.2 ANTENNA REQUIREMENTS

RESULT: PASS

5.1.3 RESTRICTED BANDS OF OPERATION

RESULT: PASS

5.2.1 RADIATED EMISSIONS OF TRANSMITTER (CARRIER, SPURIOUS AND HARMONICS)

RESULT: PASS

5.2.2 20dB BANDWIDTH

RESULT: PASS

5.3.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER

RESULT: PASS

Contents

1.	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS	4
2.	TEST SITES	4
2.1	TEST FACILITIES	4
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS	5
2.3	MEASUREMENT UNCERTAINTY	7
3.	GENERAL PRODUCT INFORMATION	8
3.1	PRODUCT FUNCTION AND INTENDED USE.....	8
3.2	SYSTEM DETAILS	8
3.3	CLOCK FREQUENCIES	9
3.4	NOISE SUPPRESSING PARTS.....	9
4.	TEST SET-UP AND OPERATION MODES	10
4.1	TEST METHODOLOGY	10
4.2	OPERATION MODES	10
4.3	PHYSICAL CONFIGURATION FOR TESTING	10
4.4	TEST SOFTWARE	11
4.5	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	11
4.6	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	12
5.	TEST RESULTS RADIO	13
5.1	TECHNICAL REQUIREMENTS.....	13
5.1.1	<i>Supply Voltage Requirements</i>	<i>13</i>
5.1.2	<i>Antenna Requirements</i>	<i>13</i>
5.1.3	<i>Restricted Bands of Operation</i>	<i>14</i>
5.2	RADIATED MEASUREMENTS	15
5.2.1	<i>Radiated Emissions of Transmitter (Carrier, Spurious and Harmonics).....</i>	<i>15</i>
5.2.2	<i>20dB Bandwidth</i>	<i>21</i>
5.3	AC POWER LINE CONDUCTED MEASUREMENTS.....	23
5.3.1	<i>AC Power Line Conducted Emission of Transmitter.....</i>	<i>23</i>
6.	PHOTOGRAPHS OF THE TEST SETUP.....	26
7.	LIST OF TABLES.....	30
8.	LIST OF FIGURES	30
9.	LIST OF PHOTOGRAPHS.....	30

1. General Remarks

1.1 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland Japan Ltd. – Global Technology Assessment Center
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 299054.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017 according to ISO/IEC 17025:2005.



TÜV Rheinland Japan Ltd. is accredited by the Federal Communications Commission as a Conformity Assessment Body under Designation Number JP0017 and Test Firm Registration Number 386498.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
For AC Power Line Conducted Emission					
Conducted Emission Measurement Software	Toyo Corporation	EP5/CE	Ver. 5.0.20	RF-0025	2016-01
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2016-03
LISN	Rohde & Schwarz	ENV216	100276	RF-0016	2016-05
For Radiated Emission					
Radiated Emission Measurement Software (below 30MHz)	Toyo Corporation	EP5/ME	Ver. 5.0.10	RF-0172	2016-01
Radiated Emission Measurement Software (above 30MHz)	Toyo Corporation	EP7/RE	Ver. 5.0.2	RF-0026	2016-01
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2015-09
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2016-03
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	2016-01
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	2016-05
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB9168	9168-475	RF-0462	2015-12
Biconical Antenna, 30-300MHz	EMCO	3110B	9603-2379	RF-0207	2015-08
Log-Periodic Antenna, 300-1000MHz	Schwarzbeck	UHALP 9108 A1	UHALP 9108-A 0845	RF-0287	2015-08
3dB Attenuator	Tamagawa Electronics	CFA-01	-	RF-0265	2016-01
10dB Attenuator	Hewlett Packard	8491A 10dB	58354	RF-0314	2016-01
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2016-01
Low Pass Filter, DC-1GHz	R&K	LP1000CH3	12104001	RF-0515	2016-01
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120D	1059	RF-0553	2016-06
Microwave Preamplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2016-01
Band Reject Filter, 1-8GHz	Nitsuki	NF-49BT	027	RF-0131	2016-01
Horn Antenna with Preamplifier, 8-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2016-07
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	006	RF-0334	2016-07

Produkte
Products

Prüfbericht - Nr.:**50031017 001****Seite 6 von 30**

Test Report No.:

Page 6 of 30

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
Horn Antenna with Preamplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2016-07
Horn Antenna with Preamplifier, 26.5-40GHz	Toyo Corporation	HAP26-40N	00000007	RF-0069	2015-08
Preamplifier, 26.5-40GHz	Toyo Corporation	HAP2640-S	-	RF-0258	2016-01
For Transmitter and Receiver Radiated Spurious Emission (above 40GHz)					
Spectrum Analyzer	Agilent	E4447A	MY48250005	BT-8267	2015-12
Signal Generator (250kHz-50GHz)	Agilent	E8257D	US49280506	RF-0426	N/A
Harmonic Mixer 40-60GHz	Agilent	11970U	MY30030222	BT-8348	2016-01
Horn Antenna 40-60GHz (RX)	Custom Microwave Inc.	HO19R	-	BT-8334	N/A
Horn Antenna 40-60GHz (TX)	Custom Microwave Inc.	HO19R	-	RF-0433	N/A
Preselected Mixer 50-75GHz	Agilent	11974VE1	MY30010118	BT-8349	2016-01
Harmonic Mixer 50-75GHz	Agilent	11970V	MY30033072	BT-8367	2016-01
Horn Antenna 50-75GHz (RX)	Custom Microwave Inc.	HO15R	-	BT-8336	N/A
Source Module (50 to 75GHz)	OML Inc.	S15MS-AG	101116-1	RF-0429	N/A
Variable Attenuator (50-75GHz)	Mi-Wave	520V/385 DC1045	-	RF-0437	N/A
Horn Antenna 50-75GHz (TX)	Custom Microwave Inc.	HO15R	-	RF-0434	N/A
Harmonic Mixer 75-110GHz	Agilent	11970W	MY25210462	BT-8350	2016-01
Horn Antenna 75-110GHz (RX)	Custom Microwave Inc.	HO10R	-	BT-8338	N/A
Source Module (75 to 110GHz)	OML Inc.	S10MS-AG	110104-1	RF-0431	N/A
Variable Attenuator (75-110GHz)	Mi-Wave	520W/387 DC1045	-	RF-0438	N/A
Horn Antenna 75-110GHz (TX)	Custom Microwave Inc.	HO10R	-	RF-0435	N/A
Constant Voltage Constant Frequency Stabilizers and Power Accessories					
CVCF (Shielded Room)	NF Corporation	ES2000S	9075612	RF-0210	N/A
CVCF Booster (Shielded Room)	NF Corporation	ES2000B	9074403	RF-0211	N/A
CVCF (10m Chamber)	NF Corporation	ES2000U	9067307	RF-0212	N/A
CVCF Booster (10m Chamber)	NF Corporation	ES2000B	9074408	RF-0213	N/A

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
AC Power Line Conducted Emission	150kHz - 30MHz	±2.0dB
Radiated Emission	9kHz – 150kHz	±4.0dB
	150kHz - 30MHz	±4.7dB
	30MHz - 1GHz	±4.7dB
	1GHz – 40GHz	±4.7dB
Radiated Emission (MMW)	40GHz - 50GHz	±4.6dB
	50GHz - 75GHz	±5.0dB
	75GHz – 110GHz	±5.0dB

3. General Product Information

3.1 Product Function and Intended Use

The **EUTs** (Equipment Under Test) are RF modules to be incorporated into a movement sensor based on Doppler effect Radar. The modules comprise transmitter and receiver. Since the receiver does not employ a local oscillator, the measurement output signal is derived directly from the difference of the emitted and received frequency (homodyne system). Receiver and transmitter can only be operated simultaneously.

3.2 System Details

Specified output power:	Typ. +16dBm (E.I.R.P)
Antenna gain:	+9.2dBi
Antenna type:	Patch antenna (printed on PCB)
Antenna mounting type:	Internal
Frequency range:	24.075 to 24.175GHz
Nominal Frequency	24.125GHz
Number of channels:	1 (Fixed)
Modulation type:	No modulation (CW only)
FCC classification:	FDS
Emission designator:	56K9N0N for NJR4269F3V1 165KN0N for NJR4269F3V2
Rated voltage:	DC 4.75 to 5.25V for NJR4269F3V1 DC 2.95 to 3.35V for NJR4269F3V2
Rated current:	30 to 35mA
Protection class:	III
Test voltage:	AC 120V for AC/DC Adapters DC 5.0V for NJR4269F3V1 DC 3.3V and 3.0V (*) for NJR4269F3V2
Test frequency:	60Hz for AC/DC Adapters

Note: (*) Two typical rating of commercial available AC/DC adapters were used for the model NJR4269F3V2.

Difference between model NJR4269F3V1 and NJR4269F3V2 is related resistor values only in order to supply each RF circuit with the same DC voltage. Therefore, Radio circuits assume to be identical at the both two models.

3.3 Clock Frequencies

Nothing mentioned explicitly.

3.4 Noise Suppressing Parts

Refer to schematics.

4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207 and 15.209.

The test methods, which have been used, are based on ANSI C63.10-2013.

For details, see under each test item.

4.2 Operation Modes

The basic operation mode used for testing is:

- A. Intended operation continuous transmission and receiving at the channel (24.125GHz), a continuous wave with 100% duty cycle.

4.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis and the test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

Figure 1: Block Diagram

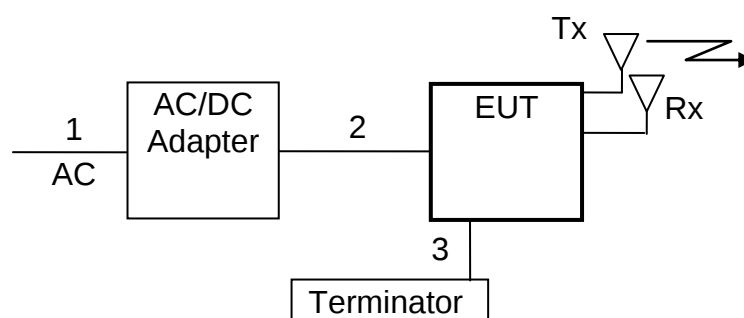


Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	AC Mains for AC / DC Adapter	1.8m, Un-shielded	AC Input Power Port
2.	DC Mains	1.8m (*), Un-shielded	DC Input Power Port
3.	Doppler signal output	0.2m (*), Shielded	Signal Line

Notes:

(*) Although all interface ports of the EUT are designed as **direct plug-in type** by manufacturer's specification, these ports were connected with cables as listed above table for the testing purpose.

EUT does not need any second radio device for the radio operating, since the EUT is a radar device and does not do any data communication function.

Representative AC/DC adapters provided by the customer were tested together.

Interface port No.3 was terminated with 50ohm terminator during testing.

For details, refer to section: Photographs of the Test Set-Up.

Test sample No.1 was used at each model.

4.4 Test Software

No special test software was used to operate the EUT.

4.5 Special Accessories and Auxiliary Equipment

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

- Product: AC/DC Adapter for DC 5V
 Manufacturer: UNIFIVE
 Model: UI318-05
 Rated Voltage: AC 100-240V
 Input Current: 0.4A
 Frequency: 50/60Hz
 Output Voltage: DC 5V
 Output Current: 3A
 Protection Class: II
 Serial Number: E01-0005228

2. Product: AC/DC Adapter for DC 3V
Manufacturer: GO FORWARD ENTERPRISE CORP.
Model: NP12-US0320
Rated Voltage: AC 100-240V
Input Current: 0.3A
Frequency: 50/60Hz
Output Voltage: DC 3V
Output Current: 2.0A
Protection Class: II
Serial Number: 1312-03
3. Product: AC/DC Adapter for DC 3.3V
Manufacturer: GO FORWARD ENTERPRISE CORP.
Model: GF12-US03320
Rated Voltage: AC 100-240V
Input Current: 0.3A
Frequency: 50/60Hz
Output Voltage: DC 3.3V
Output Current: 2.0A
Protection Class: II
Serial Number: 1409-07
4. Product: 50ohm terminator
Manufacturer: Unspecified
Model: Unspecified
Serial Number: Unspecified

Note:

AC/DC Adapter No. 1 was used with model NJR4269F3V1 for all tests.

For the radiated spurious measurements, both types of AC/DC adapter No. 2 and No. 3 were pre-checked for the model NJR4269F3V2.

Final measurements were conducted with the worst case AC/DC adapter No. 3. This AC/DC adapter No. 3 was used for 20dB bandwidth measurement, too.

4.6 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

5. Test Results RADIO

5.1 Technical Requirements

5.1.1 Supply Voltage Requirements

RESULT: **PASS**

Requirements:

FCC 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

Although the EUT does not have any internal DC voltage regulator to supply its RF circuit, this requirement will be covered by host equipment that incorporates the module.

This requirement must clearly be mentioned at Information to the users.

5.1.2 Antenna Requirements

RESULT: **PASS**

Requirements:

FCC 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.

Verdict:

The EUT has an internal antenna which is not user accessible. Hence it complies with the antenna requirements.

Prüfbericht - Nr.: 50031017 001*Test Report No.:***Seite 14 von 30***Page 14 of 30*

5.1.3 Restricted Bands of Operation

RESULT:**PASS**

Requirements:

FCC 15.205

Only spurious emissions are permitted in any of the restricted frequency bands, unless otherwise specified.

Verdict:

The EUT operation frequency range is 24.075 - 24.175GHz. It was verified during testing that the carrier is fully contained within the unrestricted frequency band 24.075 - 24.175GHz. Therefore only spurious emissions may be found in the restricted bands of operation and the EUT complies with the restricted frequency band requirement.

5.2 Radiated Measurements

5.2.1 Radiated Emissions of Transmitter (Carrier, Spurious and Harmonics)

RESULT:**PASS**

Date of testing: 2015-06-15, 2015-06-17, 2015-06-18
2015-06-22

Ambient temperature: 22, 22, 21, 20°C
Relative humidity: 68, 48, 66, 48%
Atmospheric pressure: 1004, 1002, 1008, 1005hPa

Frequency range: 9kHz - 100GHz
Measurement distance: 3m in the range 9kHz – 40GHz
0.3m in the range 40GHz – 100GHz
Kind of test site: Semi Anechoic Chamber

Requirements:

FCC 15.209, 15.245 and 15.205

Radiated emissions must comply with the limits specified in FCC 15.209(a), 15.245(b) (i) and (ii) and 15.205.

Test procedure:

ANSI C63.10-2013

The EUT was placed on a nonconductive turntable 1.5m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to the 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower (i.e. 100GHz) according to the ANSI C63.10-2013 Table 2 of clause 5.5. Final radiated emission measurements were made at 3m or 0.3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

For emissions between 30MHz and 1GHz, measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode. The receiver's 6dB bandwidth was set to 120kHz. For emissions above 1GHz, measurements were

Prüfbericht - Nr.: 50031017 001

Test Report No.:

Seite 16 von 30

Page 16 of 30

performed with a spectrum analyzer using the following settings: for peak field strength: RBW = 1MHz & VBW ≥ 1MHz; for average field strength: RBW = 1MHz & VBW = 10Hz.

Absorbers have been placed on the floor between the EUT and the measuring antenna for testing above 1GHz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

No spurious emissions were found in the range from 9kHz to 30MHz.

The spectra for the range from 40GHz to 100GHz taken at a distance of 0.3m did not show any spurious emission and third harmonics. Further investigations have however been made with a distance less than 0.1m in this range to confirm that no spurious or harmonic could be detected in this frequency range except for the second harmonics.

Table 4: Radiated Emissions of the Carrier and Harmonics, Average Data, Modes A (24.125GHz), NJR4269F3V1

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
24097.710	Y / V	114.2	-5.0	109.2	128.0	18.8	172	22
48202.300	Y / V	63.80 (*)	0	63.8	77.5	9.2 (*)	-/-	0

Note: No third harmonics of the carrier was found at 0.3m distance.

(*) Peak measurement data was used against Average limit instead of average measurement data.

Table 5: Radiated Emissions of the Carrier and Harmonics, Peak Data, Modes A (24.125GHz), NJR4269F3V1

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
24097.710	Y / V	114.3	-5.0	109.3	148.0	38.7	172	22
48202.300	Y / V	63.80	0	63.8	97.5	33.7	-/-	0

Note: No third harmonics of the carrier was found at 0.3m distance.

Table 6: Radiated Emissions of the Carrier and Harmonics, Average Data, Modes A (24.125GHz), NJR4269F3V2

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
24104.950	Y / V	114.4	-5.0	109.4	128.0	18.6	172	13
48221.800	Y / V	60.9	0	60.9	77.5	16.6 (*)	-/-	0

Note: No third harmonics of the carrier was found at 0.3m distance.

(*) Peak measurement data was used against Average limit instead of average measurement data.

Prüfbericht - Nr.: 50031017 001

Test Report No.:

Seite 17 von 30

Page 17 of 30

Table 7: Radiated Emissions of the Carrier and Harmonics, Peak Data, Modes A (24.125GHz), NJR4269F3V2

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
24104.950	Y / V	114.5	-5.0	109.5	148.0	38.5	172	13
48221.800	Y / V	60.9	0	60.9	77.5	16.6	-/-	0

Note: No third harmonics of the carrier was found at 0.3m distance.

Table 8: Radiated Spurious Emissions at Band Edge, Modes A (24.125GHz), NJR4269F3V1

Spurious Emission Frequency [GHz]	EUT / Antenna Orientation	Level AV [dBμV/m]	Level PK [dBμV/m]	Limit AV [dBμV/m]	Limit PK [dBμV/m]	Margin AV [dB]	Margin PK [dB]
24.075	Y / V	N/T (*)	49.94	54.00	74.00	N/T (*)	24.06

Table 9: Radiated Spurious Emissions at Band Edge, Modes A (24.125GHz), NJR4269F3V2

Spurious Emission Frequency [GHz]	EUT / Antenna Orientation	Level AV [dBμV/m]	Level PK [dBμV/m]	Limit AV [dBμV/m]	Limit PK [dBμV/m]	Margin AV [dB]	Margin PK [dB]
24.075	Y / V	N/T (*)	48.40	54.00	74.00	N/T (*)	25.6

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
 Average limit in dBμV/m is calculated as follows: Average limit = $20 \times \log_{10}(500\mu\text{V/m})$.
 Peak limit in dBμV/m is calculated as follows: Peak limit = Average limit + 20dB.

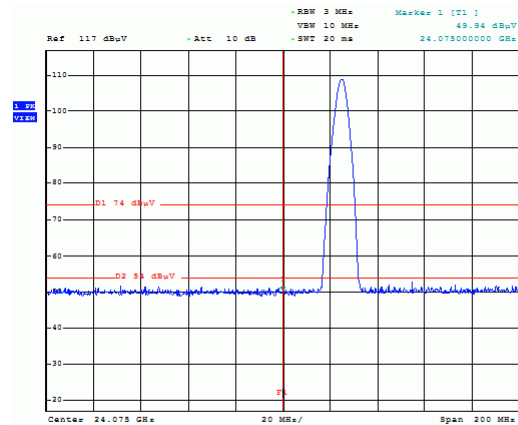
(*) Peak emissions level has met against the average limit 54dBμV/m. Therefore, average measurement was omitted.

According to the section 15.205, nearest restricted band of operation is from 23.6 to 24.0GHz. Therefore, the upper side of the band (i.e. 24.0GHz) is contained in the Figure 2.

RBW was used at 3MHz instead of 1MHz. Severe measurement values were obtained.

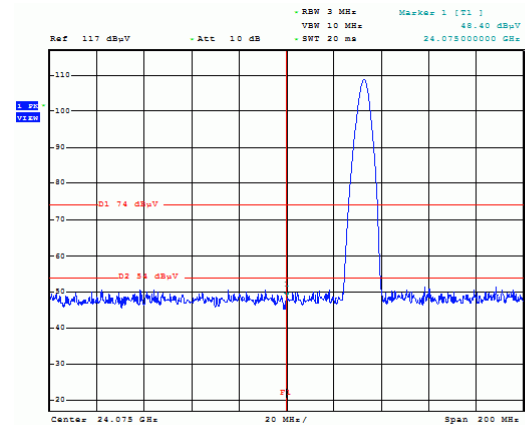
Figure 2: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (24.125GHz)

NJR4269F3V1



BandEdge, 24.075GHz, Y, V, 57

NJR4269F3V2



BandEdge, 24.075GHz, Y, V, 3.2V

Prüfbericht - Nr.: 50031017 001

Test Report No.:

Seite 19 von 30

Page 19 of 30

Table 10: Radiated Spurious Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
49.203	Y / V	33.3	-15.6	17.7	40.0	22.3	101	10
77.585	Y / V	36.1	-18.3	17.8	40.0	22.2	101	122
163.583	Y / V	34.4	-14.4	20.0	43.5	23.5	102	208
829.085	Y / V	30.8	-3.4	27.4	46.0	18.6	371	137

Note: Level QP = Reading QP + Factor

Table 11: Radiated Spurious Emissions, Average Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
4914.438	X / H	38.2	-9.5	28.7	54.0	25.3	196	351
7436.707	X / V	38.3	-2.9	35.4	54.0	18.6	194	113
12879.558	Y / V	37.9	-7.4	30.5	54.0	23.5	175	94
17036.080	Y / H	38.1	-5.7	32.4	54.0	21.6	194	116
17740.644	Y / V	38.6	-5.3	33.3	54.0	20.7	188	8
21256.620	Y / V	45.5	-3.2	42.3	54.0	11.7	134	253
28874.204	X / V	53.4	-23.2	30.2	54.0	23.8	185	234
39492.380	X / H	49.5	-16.4	33.1	54.0	20.9	175	315

Note: Level AV = Reading AV + Factor

Table 12: Radiated Spurious Emissions, Peak Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
4914.438	X / H	52.2	-9.5	42.7	74.0	31.3	196	351
7436.707	X / V	52.5	-2.9	49.6	74.0	24.4	194	113
12879.558	Y / V	51.4	-7.4	44.0	74.0	30.0	175	94
17036.080	Y / H	52.7	-5.7	47.0	74.0	27.0	194	116
17740.644	Y / V	52.5	-5.3	47.2	74.0	26.8	188	8
21256.620	Y / V	56.9	-3.2	53.7	74.0	20.3	134	253
28874.204	X / V	67.2	-23.2	44.0	74.0	30.0	185	234
39492.380	X / H	63.6	-16.4	47.2	74.0	26.8	175	315

Note: Level PK = Reading PK + Factor

Prüfbericht - Nr.: 50031017 001

Test Report No.:

Seite 20 von 30

Page 20 of 30

Table 13: Radiated Spurious Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
41.901	X / V	44.9	-15.5	29.4	40.0	10.6	100	151
61.257	X / V	44.9	-16.4	28.5	40.0	11.5	101	196
61.618	X / H	44.1	-15.9	28.2	40.0	11.8	261	34
117.585	X / V	43.5	-17.0	26.5	43.5	17.0	100	176
900.760	X / H	30.9	-2.4	28.5	46.0	17.5	204	51

Note: Level QP = Reading QP + Factor

Table 14: Radiated Spurious Emissions, Average Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
3047.734	X / V	39.6	-14.5	25.1	54.0	28.9	196	13
3572.953	X / H	39.2	-13.3	25.9	54.0	28.1	175	214
7893.488	X / V	37.9	-2.5	35.4	54.0	18.6	199	326
13683.613	Y / V	37.7	-6.0	31.7	54.0	22.3	197	86
15278.810	Y / H	38.2	-5.7	32.5	54.0	21.5	179	20
19356.796	Y / H	45.6	-4.1	41.5	54.0	12.5	196	116
28874.204	X / V	53.4	-23.2	30.2	54.0	23.8	185	234
39492.380	X / H	49.5	-16.4	33.1	54.0	20.9	175	315

Note: Level AV = Reading AV + Factor

Table 15: Radiated Spurious Emissions, Peak Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
3047.734	X / V	53.8	-14.5	39.3	74.0	34.7	196	13
3572.953	X / H	53.3	-13.3	40.0	74.0	34.0	175	214
7893.488	X / V	52.0	-2.5	49.5	74.0	24.5	199	326
13683.613	Y / V	51.8	-6.0	45.8	74.0	28.2	197	86
15278.810	Y / H	51.9	-5.7	46.2	74.0	27.8	179	20
19356.796	Y / H	56.0	-4.1	51.9	74.0	22.1	196	116
39450.216	X / V	62.8	-16.6	46.2	74.0	27.8	146	359
39492.444	X / H	63.1	-16.4	46.7	74.0	27.3	138	275

Note: Level PK = Reading PK + Factor

5.2.2 20dB Bandwidth**RESULT:****PASS**

Date of testing: 2015-06-25

Ambient temperature: 23°C

Relative humidity: 46%

Atmospheric pressure: 1006hPa

Requirements:

FCC 15.215(c)

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band.

Since frequency stability is not specified in the regulations section 15.245, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test procedure:

ANSI C63.10-2013

The 20dB bandwidth was measured with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 1kHz and the video bandwidth to 3kHz.

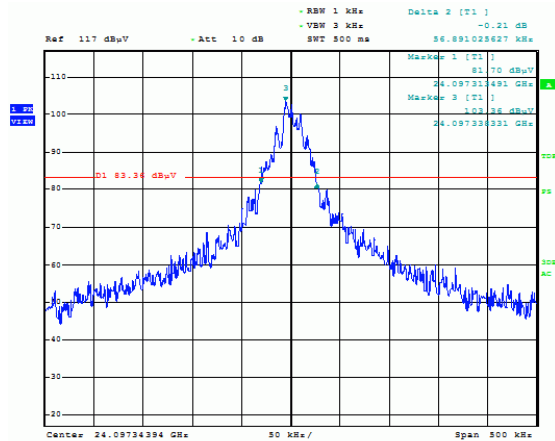
Table 16: 20dB Bandwidth

Model	Nominal Operating Frequency [GHz]	Actual Center Frequency [GHz]	20dB Bandwidth [kHz]
NJR4269F3V1	24.125GHz	24.097313	56.891
NJR4269F3V2	24.125GHz	24.103897	165.392

Note: Since 80% of the permitted band (i.e. 24.075 to 24.175GHz) is from 24.085 to 24.165GHz, each actual center frequency as listed here above is within this 80% of the band.

Figure 3: Radiated Emissions at 20dB Bandwidth, Spectral Diagram, Mode A (24.125GHz)

NJR4269F3V1



20dB Bandwidth, Y. V, AC Adapter 5V, Span 500k

NJR4269F3V2



20dB Bandwidth, Y. V, AC Adapter 3.3V

Note: This 20 dB bandwidth of the emission is contained within the frequency band.

5.3 AC Power Line Conducted Measurements

5.3.1 AC Power Line Conducted Emission of Transmitter

RESULT:**PASS**

Date of testing: 2015-06-22

Ambient temperature: 25°C

Relative humidity: 59%

Atmospheric pressure: 1009hPa

Frequency range: 0.15 - 30MHz

Kind of test site: Shielded Room

Requirements:

FCC 15.207

The AC power line conducted emission on any frequency within the band 150kHz to 30MHz shall not exceed the limits specified in FCC 15.207.

Test procedure:

ANSI C63.10-2013

The EUT was placed on a wooden table raised 80cm above the reference ground plane. A vertical conducting plane of the screened room was located 40cm to the rear of the EUT. The AC adapter of the EUT was connected to a Line Impedance Stabilization Network (LISN).

The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude and frequency in order to ensure that maximum emission amplitudes were attained.

The measurements were performed with a test receiver operating in the CISPR quasi-peak and average detection modes. The receiver's 6dB bandwidth was set to 9kHz.

Disturbances other than those mentioned are small or not detectable.

Prüfbericht - Nr.: 50031017 001

Test Report No.:

Seite 24 von 30

Page 24 of 30

Table 17: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V1

Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.15550	-	30.5	12.5	9.6	40.1	22.1	65.7	55.7	25.6	33.6
0.21330	+	24.1	8.4	9.6	33.7	18.0	63.1	53.1	29.4	35.1
0.38526	-	17.4	14.1	9.7	27.1	23.8	58.2	48.2	31.1	24.4
0.40420	+	18.0	14.6	9.7	27.7	24.3	57.8	47.8	30.1	23.5
0.44580	+	19.4	16.5	9.6	29.0	26.1	57.0	47.0	28.0	20.9
0.68440	+	9.7	5.5	9.7	19.4	15.2	56.0	46.0	36.6	30.8
0.68694	-	9.8	5.7	9.7	19.5	15.4	56.0	46.0	36.5	30.6
9.73450	+	7.5	4.1	10.0	17.5	14.1	60.0	50.0	42.5	35.9
10.09423	-	7.3	4.0	10.0	17.3	14.0	60.0	50.0	42.7	36.0

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

Table 18: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V2 at 3V

Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.26422	-	35.8	17.3	9.7	45.5	27.0	61.3	51.3	15.8	24.3
0.26467	+	33.2	15.4	9.7	42.9	25.1	61.3	51.3	18.4	26.2
0.40650	+	31.5	23.0	9.8	41.3	32.8	57.7	47.7	16.4	14.9
0.40727	-	32.3	20.9	9.7	42.0	30.6	57.7	47.7	15.7	17.1
0.52473	+	27.4	9.2	9.8	37.2	19.0	56.0	46.0	18.8	27.0
0.52553	-	26.4	5.7	9.7	36.1	15.4	56.0	46.0	19.9	30.6
0.52678	-	26.6	5.9	9.7	36.3	15.6	56.0	46.0	19.7	30.4
0.78741	-	24.9	7.1	9.8	34.7	16.9	56.0	46.0	21.3	29.1
0.78769	+	27.2	12.1	9.8	37.0	21.9	56.0	46.0	19.0	24.1
1.04787	+	27.7	10.4	9.8	37.5	20.2	56.0	46.0	18.5	25.8
1.05106	-	25.9	6.2	9.8	35.7	16.0	56.0	46.0	20.3	30.0
1.21885	-	22.2	8.7	9.8	32.0	18.5	56.0	46.0	24.0	27.5
1.30976	+	26.1	9.1	9.8	35.9	18.9	56.0	46.0	20.1	27.1
1.31264	-	24.1	4.8	9.8	33.9	14.6	56.0	46.0	22.1	31.4
1.57039	+	22.1	6.6	9.8	31.9	16.4	56.0	46.0	24.1	29.6
2.43752	-	17.1	3.1	9.9	27.0	13.0	56.0	46.0	29.0	33.0
2.61938	+	14.0	1.4	9.9	23.9	11.3	56.0	46.0	32.1	34.7
3.13947	-	13.0	-1.1	10.0	23.0	8.9	56.0	46.0	33.0	37.1
6.28346	+	6.2	-2.7	10.1	16.3	7.4	60.0	50.0	43.7	42.6
6.54454	-	6.7	-3.8	10.2	16.9	6.4	60.0	50.0	43.1	43.6

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

Table 19: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V2 at 3.3V

Freq. [MHz]	Phase	Reading QP [dBμV]	Reading AV [dBμV]	Factor [dB]	Level QP [dBμV]	Level AV [dBμV]	Limit QP [dBμV]	Limit AV [dBμV]	Margin QP [dB]	Margin AV [dB]
0.21320	-	15.8	7.4	9.6	25.4	17.0	63.1	53.1	37.7	36.1
0.21327	+	16.1	7.5	9.6	25.7	17.1	63.1	53.1	37.4	36.0
0.55990	-	28.3	16.9	9.7	38.0	26.6	56.0	46.0	18.0	19.4
0.57422	+	28.4	11.5	9.7	38.1	21.2	56.0	46.0	17.9	24.8
1.11539	-	17.7	6.7	9.7	27.4	16.4	56.0	46.0	28.6	29.6
1.15656	+	17.3	4.5	9.7	27.0	14.2	56.0	46.0	29.0	31.8
9.76462	+	16.7	4.3	10.0	26.7	14.3	60.0	50.0	33.3	35.7
9.99086	-	14.9	3.9	10.0	24.9	13.9	60.0	50.0	35.1	36.1

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

7. List of Tables

Table 1: List of Test and Measurement Equipment	5
Table 2: Emission Measurement Uncertainty	7
Table 3: Interfaces present on the EUT	11
Table 4: Radiated Emissions of the Carrier and Harmonics, Average Data, Modes A (24.125GHz), NJR4269F3V1	16
Table 5: Radiated Emissions of the Carrier and Harmonics, Peak Data, Modes A (24.125GHz), NJR4269F3V1	16
Table 6: Radiated Emissions of the Carrier and Harmonics, Average Data, Modes A (24.125GHz), NJR4269F3V2	16
Table 7: Radiated Emissions of the Carrier and Harmonics, Peak Data, Modes A (24.125GHz), NJR4269F3V2	17
Table 8: Radiated Spurious Emissions at Band Edge, Modes A (24.125GHz), NJR4269F3V1	17
Table 9: Radiated Spurious Emissions at Band Edge, Modes A (24.125GHz), NJR4269F3V2	17
Table 10: Radiated Spurious Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1	19
Table 11: Radiated Spurious Emissions, Average Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1	19
Table 12: Radiated Spurious Emissions, Peak Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V1	19
Table 13: Radiated Spurious Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2	20
Table 14: Radiated Spurious Emissions, Average Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2	20
Table 15: Radiated Spurious Emissions, Peak Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz), NJR4269F3V2	20
Table 16: 20dB Bandwidth	21
Table 17: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V1	24
Table 18: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V2 at 3V	24
Table 19: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (-) and (+), Mode A (24.125GHz) NJR4269F3V2 at 3.3V	25

8. List of Figures

Figure 1: Block Diagram	10
Figure 2: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (24.125GHz)	18
Figure 3: Radiated Emissions at 20dB Bandwidth, Spectral Diagram, Mode A (24.125GHz)	22

9. List of Photographs

Photograph 1: Set-up for AC Power Line Conducted Emission of Transmitter, Front View	26
Photograph 2: Set-up for AC Power Line Conducted Emission of Transmitter, Rear View	26
Photograph 3: Set-up for Radiated Emission of Transmitter, Front View	27
Photograph 4: Set-up for Radiated Emission of Transmitter, MMW General View	27
Photograph 5: Set-up for Radiated Emission, EUT Configuration X-Axis	28
Photograph 6: Set-up for Radiated Emission, EUT Configuration Y-Axis	28
Photograph 7: Set-up for Radiated Emission, EUT Configuration Z-Axis	29