



EUROFINS ETS PRODUCT SERVICE GMBH

TEST - REPORT

**FCC RULES PARTS 15.247
IC RADIO STANDARDS RSS-210 - Issue 7**

FCC ID: SIFNANOLOCAVR0108

Model Name: nanoLOC AVR Module

Test report no.:G0M20801-0415-C-1



Certificate #1983.01



Eurofins ETS Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde,
Germany

Phone +49-33631-888 00
Fax +49-33631-888 660

TABLE OF CONTENTS

1	General information	2
1.1	Notes	2
1.2	Testing laboratory	3
1.3	Details of approval holder	4
1.4	Application details	4
1.5	Test item	4
1.6	Test standards	6
2	Technical test	6
2.1	Summary of test results	6
2.2	Test environment	6
2.3	Test equipment utilized	7
2.4	Test Procedure	17
3	Test results	18
3.1	Transmitter parameters	19
3.1.1	RF power output, conducted	19
3.1.2	RF power output, radiated (EIRP)	20
3.1.3	6 db bandwidth; Occupied bandwidth (99% BW)	21
3.1.4	Peak power spectral density	22
3.1.5	Spurious emissions, conducted	23
3.1.6	Spurious emissions, radiated	24
3.1.7	AC power line conducted emissions	27
3.2	Receiver parameters	28
3.2.1	Spurious emissions	28
APPENDIX		29

1 General information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.

The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.

Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.

Neither is there any guarantee that such a test sample will interwork with other genuinely open systems.

The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that its performance generally conforms to representative cases of communications equipment.

The test results of this test report relate exclusively to the item tested as specified in 1.5.

The test report may only be reproduced or published in full.

Reproduction or publication of extracts from the report requires the prior written approval of the Eurofins ETS Product Service GmbH.

Tester:

06.01.2008		M. Schlaps	
Date	ETS-Lab.	Name	Signature

Technical responsibility for area of testing:

06.01.2008		K. Damm	
Date	ETS	Name	Signature

1.2 Testing laboratory

1.2.1 Location

EUROFINS ETS PRODUCT SERVICE GMBH
Storkower Straße 38c
D-15526 Reichenwalde b. Berlin
Germany
Telephone : +49 33631 888 00
Telefax : +49 33631 888 660

1.2.2 Details of accreditation status

DAR ACCREDITED TESTING LABORATORY

DAR-REGISTRATION NUMBER: DAT-P-268/08

RECOGNIZED NOTIFIED BODY EMC

REGISTRATION NUMBER: BNetzA-bS EMV-07/61

RECOGNIZED NOTIFIED BODY R&TTE

REGISTRATION NUMBER: BNetzA-bS-02/51-53

FCC FILED TEST LABORATORY

REG.-No. 96970

A2LA ACCREDITED TESTING LABORATORY

CERTIFICATE No. 1983.01

BLUETOOTH QUALIFICATION TEST FACILITY (BQTF)

ACCREDITED BY BLUETOOTH QUALIFICATION REVIEW BOARD

INDUSTRY CANADA FILED TEST LABORATORY

REG. No. IC 3470

1.2.3 Test location, where different:

Name	: ./.
Street	: ./.
Town	: ./.
Country	: ./.
Telephone	: ./.
Fax	: ./.

1.3 Details of approval holder

Name : Nanotron Technologies GmbH
Street : Alt-Moabit 60
Town : D-10555 Berlin
Country : Germany
Telephone : +49.30.399954202
Fax : +49.30.399954202

Contact : Herr Dr. Frank Schlichting
E-Mail : f.schlichting@nanotron.com

1.4 Application details

Date of receipt of application : 28.01.2008
Date of receipt of test item : 28.01.2008
Date of test : 29.01.2008

1.5 Test item

Description of test item : nanoLOC AVR Module
Type identification : nanoLOC AVR
Serial number : without
Photos : See appendix A.

Technical data

Frequency band : 2.4 GHz – 2.4835 GHz
Number of Channels : 1
Frequency Channel : 2441.75 MHz
Operating Modes : duplex
Type of modulation : Chirp Spread Spectrum (CSS)
Fixed point-to-point operation: ☐ Yes / ☒ No
Power supply : 2.5 V DC 120 V AC (AC/DC Adapter PC device)
Antenna : internal chip antenna
Antenna gain : 0.5 dBi

Classification : For a module not determined.

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

<u>Transmitter</u>	<u>Unom</u>	<u>Umin – 15 %</u>	<u>Umax + 15 %</u>
Power (ch A)	: Conducted: 1.17 dBm	Conducted: 1.04 dBm	Conducted: 1.25 dBm

Manufacturer:
(if applicable)

Name	: Nanotron Technologies GmbH
Street	: Alt-Moabit 60
Town	: D-10555 Berlin
Country	: Germany

Additional information: This test sample is using a transmission technology based on Multi Dimensional Multiple Access (MDMA). The applied spread spectrum modulation Chirp Spread Spectrum (CSS) is using a transmitter signal which will be swepted from the lower edge of 2.4 GHz ISM band to the higher edge. It means that every signal will use the whole ISM frequency band and no further canalisation is possible. For testing appears the consequence that some measurement have to be performed at one operating frequency only. According to FCC Part 15.247(a) the used "other form of modulation" lead to determination that the sample is a digitally modulated intentional radiator.

1.6 Test standards

Technical standard : FCC Parts: 15.247
IC Standards: RSS 210 Issue 7 Annex 8.2

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

or

The deviations as specified in 2.5 were ascertained in the course of the tests performed. ☐

2.2 Test environment

Temperature : 25°C
Relative humidity content : 20 ... 75 %
Air pressure : 86 ... 103 kPa
Details of power supply : 2.5 V DC 120 V AC (AC/DC Adapter PC device)
Extrem conditions parameters: : test voltage - extreme min.: 2.3 V DC
max: 2.7 V DC

2.3 Test equipment utilized

No.	Test equipment	Type	Manufacturer
ETS 0001	ESD Gun	SESD 30000	Schlöder
ETS 0002	Test receiver	ESVP	R & S
ETS 0003	Diode Power Sensor	NRV-Z2	R & S
ETS 0004	Spektrum- and Network-Analyzer	FSMS 26	R & S
ETS 0005	RF amplifier matrix	RSU-ETS-CTR6	ETS
ETS 0006	HP-Filter	H1G04G01	Microwave
ETS 0007	Horn antenna	AT 4004	ar
ETS 0008	Antenna	Loop antenna	Siemens
ETS 0009	Comb Generator Emitter	CGE 02	York EMC Services
ETS 0011	Antenna (van Veen/Frame)	HM020Z3	R & S
ETS 0012	Biconical Antenna	HK 116	R & S
ETS 0013	LPD Antenna	HL 223	R & S
ETS 0014	Log Periodical Antenna	HL 025	R & S
ETS 0015	Log Periodical Antenna	HL 025	R & S
ETS 0016	Precision antenna kit	VHAP	Schwarzbeck
ETS 0017	Precision antenna kit	UHAP	Schwarzbeck
ETS 0018	Horn antenna	BBHA 9120 D	Schwarzbeck
ETS 0019	Horn antenna	BBHA 9120 D	Schwarzbeck
ETS 0020	Antenna	DP 21	MEB
ETS 0021	Antenna	DP 3	MEB
ETS 0022	Antenna	SAS-200/ 521	A.H. Systeme+D65
ETS 0023	Antenna	DP 1	MEB
ETS 0024	Antenna mast	AF 2	MEB
ETS 0025	Antenna mast	AF 2	MEB
ETS 0026	Tripod		Heinrich Deisel
ETS 0027	Tripod		Heinrich Deisel
ETS 0028	Tripod	STA 2	C. Lorenz AG
ETS 0029	Tripod		Berlebach
ETS 0030	Biconical Antenna	HK 116	R & S
ETS 0031	Turn table	DS 412	Heinrich Deisel
ETS 0032	Controller	HD 050	Heinrich Deisel
ETS 0033	Calibr. Set CDN	3x Adaptor 50-150 Ohm	ETS
ETS 0034	RF Generator/ Amplifier	SMLR	R & S
ETS 0035	RF Generator/ Amplifier	SMLM	R & S
ETS 0036	Zirc. Antenna	3102	EMCO
ETS 0037	Zirc. Antenna	3102L	EMCO
ETS 0038	RF amplifier	150L	Amplifier Research
ETS 0039	Absorbing clamp	MDS 21	R & S
ETS 0040	Artificial Mains Network	ESH3-Z5	R & S
ETS 0041	T-Artificial Mains Network	ESH3-Z4	R & S

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0042	Artificial Mains	ESH3-Z6	R & S
ETS 0043	Directional Coupler	1850	KRYTAR
ETS 0044	Vehicle LISN	NNBM 8125	Schwarzbeck
ETS 0045	Vehicle LISN	NNBM 8126D	Schwarzbeck
ETS 0046	Power supply	2224.7	Statron
ETS 0047	Power supply	2224.7	Statron
ETS 0048	Power supply	2224.7	Statron
ETS 0049	Power supply	2228.1	Statron
ETS 0050	Power supply	2224.2	Statron
ETS 0051	Oscilloscope	TDS 640A	Tektronix
ETS 0051a	Probe a	P6139A	Tektronix
ETS 0051b	Probe b	P6139A	Tektronix
ETS 0052	Audio analyzer	UPA 4	R & S
ETS 0056	Ultra Compact Simulator	UCS 500 M4	EM Test
ETS 0057	Motor Variac	MV 2616	EM Test
ETS 0058	Capacitive coupling clamp	E 502 B	Keytek/ EMC
ETS 0059	Kikusui amplifier	PCR 2000L	Keytek/ EMC
ETS 0064	CDN IEC 61000-4-6		Keytek/ EMC
ETS 0066	EM Injection Clamp		FCC/ EMC
ETS 0067	Calibration Fixture	IEC 801-2031 CF	FCC/ EMC
ETS 0068	CDN IEC 61000-4-6	CDN	FCC/ EMC
ETS 0069	EM Radiation Monitor	EMR-20	W & G
ETS 0070	PC Transfer set EMR-20	EMR-20	W & G
ETS 0071	Video camera system	KMB012	Kocom
ETS 0072	Interphone system	JS-1400	Jiuh Sheng
ETS 0073	Audio noise meter	GSM 2	MKD/ RFT
ETS 0075	NF Generator	GF 22	Präcitronic
ETS 0076	Feeding bridge A	SBA 1000	ESP
ETS 0078	LCR meter	SR 720	SRS
ETS 0079	Functional Generator	MX-2020	Maxcom
ETS 0082	PC system		Esotronic
ETS 0085	Shielded room	SR 1	Frankonia
ETS 0086	Semi-Anechoic chamber	AC 1	Frankonia
ETS 0087	Climatic cell	HC 4033	Heraeus
ETS 0088	Color TV pattern Generator	PM 5518-TX VPS	Philips
ETS 0089	Radio Communication tester	CMS 54	R & S
ETS 0091	Signal Generator	SME 03	R & S
ETS 0092	Power Amplifier	150W1000	AR Amplifier Research
ETS 0093	Attenuator	57-20-33	Weinschel
ETS 0094	Power Sensor	NRV-Z55	R & S
ETS 0095	DECT system controller	PSMD	R & S
ETS 0096	DECT Signaling unit	PSMD-B11	R & S
ETS 0097	Rack, 19", 36 HU	TS 89RA	R & S
ETS 0098	System engineering and software	CS 893BE	R & S

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0099	Extension unit for basic version	TS 8930B	R & S
ETS 0100	Signal Generator	SME-06	R & S
ETS 0101	Power Amplifier	50W1000B	AR Amplifier Research
ETS 0102	CDN	M3-801/6	MEB
ETS 0103	Magnetic field test set	MF1000	EMC-Partner
ETS 0105	RF Signal Generator (High power synthesizer/ sweeper)	SMP 02 (SMP 22 / 02)	R & S
ETS 0106	Antenna	Vamp 9243	Schwarzbeck
ETS 0108	DECT protocol tester TBR 22	TS 1220	R & S
ETS 0110	Real time Signaling unit	PSMD-B2	R & S
ETS 0111	PCM Real-time audio interface for PSM	PSMD-B3	R & S
ETS 0112	Synthesizer Module	PSMD-B4	R & S
ETS 0114	RF step attenuator	RSG	R & S
ETS 0116	Protokolltester	PTW 70	R & S
ETS 0117	Insertion unit	URV5-Z2	R & S
ETS 0120	RF step attenuator	TRI-50-20	INCO
ETS 0121	Resonant loop	0003127-1880	ETS Lindgren
ETS 0122	Resonant loop	0003127-836	ETS Lindgren
ETS 0123	RF attenuator	RBU	R & S
ETS 0124	Tripod	STA 2	R & S
ETS 0125	Reference dipole	0003126-1880	ETS Lindgren
ETS 0126	Reference dipole	0003126-836	ETS Lindgren
ETS 0127	Circular polarized antenna	3102	ETS Lindgren
ETS 0128	Dual Horn Antenna	3164-04	EMCO
ETS 0136	Attenuator	33-6-34	Weinschel
ETS 0140	High voltage Generator	IP 6Wa	TPW
ETS 0141	Sliding bridge	J 573	RFT
ETS 0143	Impedance converter	TK 12	RFT
ETS 0144	Notch filter	WRCT 24000/2497-80-20SS	Wainwright
ETS 0145	Coaxial Directional	3002-20	Narda
ETS 0146	Active Voltage Probe	ESH2-Z2	R & S
ETS 0148	RF Current Probe	F-65	FCC
ETS 0149	Power divider	ZAPD-21	MCL
ETS 0150	Switcher	HR07-720	Wisi
ETS 0151	Interference pulse Generator	NSG 500C	Schaffner
ETS 0152	Simulator for Load-Dump-Impulse	NSG 506C (I)	Schaffner
ETS 0153	Simulator for Load-Dump-Impulse	NSG 506C (II)	Schaffner
ETS 0155	Signal Generator	SMG	R & S
ETS 0157	TV and Sat-Signalgenerator	VTG 700	Grundig
ETS 0159	Programmable power supply	TOE 8815	Toellner
ETS 0160	Amplifier	AR 1W1000	Amplifier Research
ETS 0161	Harmonic / Flicker Analyzer	HFA 3000	Schlöder

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0162	Acoustic chamber	403-A	IAC
ETS 0163	Test head	BK 4602	Brüel & Kjær
ETS 0164	Simulator ear	BK 4185	Brüel & Kjær
ETS 0165	Simulator mouth	BK 4227	Brüel & Kjær
ETS 0166	Sound level calibrator	BK 4231	Brüel & Kjær
ETS 0167	Communication Analysis System	CAS TE I	HEAD acoustics
ETS 0168	Acoustical test for DECT	CTR 10	HEAD acoustics
ETS 0169	Measurement - Front-end (analog)	MFE III	HEAD acoustics
ETS 0170	Measurement - Front-end (digital)	MFE IV	HEAD acoustics
ETS 0171	Electronic test cradle	TEH	HEAD acoustics
ETS 0172	Noise Generator	HNG III.1	HEAD acoustics
ETS 0173	Speaker	Canton S Pluss	HEAD acoustics
ETS 0174	Measurement - Front-end line interface	MFE V	HEAD acoustics
ETS 0175	Software Line interface (analog)	COPTZV5	HEAD acoustics
ETS 0176	Acoustic volt meter	COP 4	HEAD acoustics
ETS 0177	Feeding bridge B	SBB 1000	ESP
ETS 0178	Open area test side	10m	ETS
ETS 0179	Open area test side	3 m	ETS
ETS 0186	Power supply	DF 1730	WJG
ETS 0189	Spectrum Analyzer	FSEB	R & S
ETS 0191	Sweep function Generator	7202	Dagatron
ETS 0218	RF probe	URV5-Z7	R & S
ETS 0219	Power sensor	NRV-Z2	R & S
ETS 0221	ISDN-S0-Analyzer	K1403	Siemens
ETS 0222	ISDN Protocol Analyzer	TE965	Tekelec Teleco.
ETS 0223	GSM/ PCN/ PCS-Simul.	TS8916B	R & S
ETS 0224A	Millivolt meter	URV5	R & S
ETS 0224B	Diode Power Sensor	NRV-Z1	R & S
ETS 0224C	Programmable high resolution timer counter	PM6654G	Philips
ETS 0224D	RF Stepp Attenuator	RSP	R & S
ETS 0224E	Signal Generator	SMG	R & S
ETS 0225	SIM Simulator		Orga
ETS 0226	SIM Editor		Orga
ETS 0227	Vibration table	TIRA vib	GenRad
	Accelerator	PCB_M353B33	PCB Piezotronics Inc.
ETS 0228	Climatic chamber	VT 4010	Vötsch
ETS 0229	Radio Communication. Tester	CMT 54	R & S
ETS 0230	Radio Communication. Tester	CMD 65	R & S
ETS 0232	Radiation test source	VSQ 1	MEB
ETS 0233	Direction coupler	RK 100	MEB
ETS 0234	Power meter	NRVD	R & S
ETS 0235	RF-network-Analyzer	8752 C	HP

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0236	RF-amplifier	100A100	ar
ETS 0237	RF-amplifier	100W1000M1	ar
ETS 0238	Field strong meter	FM 2000	ar
ETS 0239	Isotropic field probe 40 GHz	FP 2080 Kit	ar
ETS 0240	Isotropic field probe 1 GHz	FP 2000 Kit	ar
ETS 0241	Pulse Generator	4050	PicoSecond PL
ETS 0244	Ultra Compact Simulator	UCS 200 M	EM-Test
ETS 0245	Load dump Generator	LD 200 B1	EM-Test
ETS 0246	Voltage drop simulator	VDS 200	EM-Test
ETS 0247	Calibration adaptor	KW50	EM-Test
ETS 0248	Calibration adaptor	KW1000	EM-Test
ETS 0251	Climatic chamber	VT 4004	Vötsch
ETS 0252	System controller	PSM 12	R & S
ETS 0253	Spectrum Analyzer	FSIQ 26	R & S
ETS 0254	RF Generator	SMIQ 03	R & S
ETS 0255	RF Generator	SMIQ 03	R & S
ETS 0256	RF Generator	SMR 27	R & S
ETS 0257	Step attenuator	RSP	R & S
ETS 0258	Rubidium standard	RSTU	DATUM GmbH
ETS 0259	Power meter	NRVD	R & S
ETS 0260	Power sensor	NRV-Z1	R & S
ETS 0261	Power sensor	NRV-Z1	R & S
ETS 0262	Switching unit	SSCU	R & S
ETS 0263	Signaling unit	PTW 60	R & S
ETS 0265	Loop antenna	HFRA 9150	Schwarzbeck
ETS 0266	Messadapter 1:100	50 Ohm	
ETS 0267	RF Signal Generator	SMT 03	R & S
ETS 0268	Signal Generator	SMP 02	R & S
ETS 0269	RF bridge 50 Ohm	86205 A	Agilent
ETS 0270	Signal Generator	SMP 04	R & S
ETS 0271	Spectrum Analyzer	FSEK 30	R & S
ETS 0272	Signal Generator	SME 03	R & S
ETS 0273	Signal Generator	SME 03	R & S
ETS 0274	Signal Generator	SMY 01	R & S
ETS 0275	Power sensor	NRV-Z51	R & S
ETS 0276	Audio Analyzer	UPL 16	R & S
ETS 0277	Power sensor	NRV-Z1	R & S
ETS 0278	Power sensor	NRV-Z31	R & S
ETS 0279	Step attenuator	RSP	R & S
ETS 0280	Power meter	NRVD	R & S
ETS 0281	Spectrum Analyzer	FSM	R & S
ETS 0282	RF bridge 75 Ohm	86207 A	HP
ETS 0283	RF bridge 50 Ohm	86205 A	HP

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0284	Field probe	11940 A	HP
ETS 0285	Field probe	11941 A	HP
ETS 0286	Limithier	11867 A	HP
ETS 0287	EMI Test receiver	ESHS10	R & S
ETS 0288	Artificial mains	ESH2-Z5	R & S
ETS 0289	Audio Generator	TAG 101	Troneer
ETS 0290	Audio Generator	TAG 101	Troneer
ETS 0291	Loop antenna	HFH2-Z2	R & S
ETS 0292	RF Generator	SMHU	R & S
ETS 0293	Artificial mains	NNBM 8125	Schwarzbeck
ETS 0294	Biconical antenna	HK 116	R & S
ETS 0295	LPD antenna	HL 223	R & S
ETS 0296	GTEM cell	GTEM 500	Schaffner
ETS 0297	Power pulse Generator	IGUF 2910	Schwarzbeck
ETS 0299	DECT protocol tester	TS 1220	R & S
ETS 0300	RF amplifier	75 A 250	ar
ETS 0301	Relay switch unit	RSU	R & S
ETS 0302	Data line CDN	CM-I/O CD	Keytek
ETS 0303	Telecom line CDN	CM-TEL CD	Keytek
ETS 0306	Function Generator	HP 33120A	HP
ETS 0307	Commu. Sign. Analyzer	CSA 803 A	Tektronix
ETS 0308	Spectrum analyzer	R 3361A	Advantest
ETS 0309	Anechoic chamber	AC 2	Frankonia
ETS 0310	Anechoic chamber	AC 3	Frankonia
ETS 0311	Anechoic chamber	AC 4	Frankonia
ETS 0313	Power sensor	NRV-Z51	R & S
ETS 0314	LPD antenna	HL 223	R & S
ETS 0315	Biconical antenna	HK 116	R & S
ETS 0316	Switcher	Hr 07-720	WISI
ETS 0318	Dial pulse/ DTMF tester	210	HE
ETS 0319	Opto link	GPIB 140	NI
ETS 0320	Opto link	GPIB 140	NI
ETS 0322	Insertion unit	URV5-Z4	R & S
ETS 0328	ELF Field Strenght Measurement System	HI-3604	Holaday Ind., INC.
ETS 0329	VDT / VLF Radiation Measurement System	HI-3603	Holaday Ind., INC.
ETS 0330	Fiber Optic Remote Control	HI-3616	Holaday Ind., INC.
ETS 0331	TS 1220		
ETS 0332	PSM		
ETS 0333	Turn table	DE 350	Heinrich Deisel
ETS 0334	Controller	HD 100	Heinrich Deisel
ETS 0336	LPD antenna	HL 223	R & S
ETS 0338	Coupling network	KN002	ETS

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0339	Isolating Transformer	KN003	ETS
ETS 0347	Current Probe	EZ-17	R & S
ETS 0348	RF Millivolt meter	URV 55	R & S
ETS 0350	Horn Antenna	BBHA 9120-C	Schwarzbeck
ETS 0351	RF amplifier	DWT-18057	Microwave
ETS 0354	RF amplifier	DBS-0408N423	Microwave
ETS 0355	high pass	H03G12G3	Microwave
ETS 0356	high pass	H03G12G3	Microwave
ETS 0357	high pass	H08G18G3	Microwave
ETS 0358	RF amplifier	AFD3-010040-15-In	MITEQ
ETS 0359	RF amplifier	M/N AM-1331	MITEQ
ETS 0360	RF amplifier	DBS-0408N423	Microwave
ETS 0361	RF amplifier	DBS 1826N515	Microwave
ETS 0362	high pass	H03G12G3	Microwave
ETS 0363	high pass	H08G18G3	Microwave
ETS 0364	high pass	H08G18G3	Microwave
ETS 0365	Notch filter 2.4 GHz	WRCT2.40/248	Wain Wright
ETS 0366	high pass	H08G18G3	Microwave
ETS 0367	high pass	H03G12G3	Microwave
ETS 0368	Notch filter 0.5-1 GHz	BN86883	Schomandl
ETS 0369	Notch filter 210-500 MHz	BN86882	Schomandl
ETS 0370	Notch filter 15-90 MHz	BN86880	Schomandl
ETS 0371	Notch filter 85-250 MHz	BN86881	Schomandl
ETS 0372	Direction coupler	RK 100	MEB
ETS 0373	Direction coupler	DC3001	EMC
ETS 0374	DC Power Supply	NGSM32	R & S
ETS 0375	Vector Signal Gener.	SMIQ03B	R & S
ETS 0376	Signal Generator	SMP22	R & S
ETS 0377	Advanced Signal Conditioning Unit	ASCU850	R & S
ETS 0378	Advanced Signal Conditioning Unit	ASCU190	R & S
ETS 0379	Advanced Signal Conditioning Unit	ASCU180	R & S
ETS 0380	Advanced Signal Conditioning Unit	ASCU900	R & S
ETS 0381	Ethernet HUB	CS-HUB	R & S
ETS 0382	Vector Signal Gener.	SMIQ03B	R & S
ETS 0383	Spectrum Analyzer	FSU26	R & S
ETS 0384	Main Frame Signal and Conditioning Unit	SSCU-GW	R & S
ETS 0385	Protocol Slave	CRTU-RU (CRTU-G)	R & S
ETS 0386	Power meter	NRVD	R & S
ETS 0387	Power Sensor	NRV-Z1	R & S
ETS 0388	Power Sensor	NRV-Z1	R & S
ETS 0389	Fading Simulator	ABFS	R & S
ETS 0390	System PC PC3600	TS-PC36	R & S

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0391	Rubidium Frequency Standard	DATUM 8040	DATUM GmbH
ETS 0392	RF Distribution	DATUM 6502	DATUM GmbH
ETS 0393	Insertion unit	URV5-Z4	R & S
ETS 0394	Advanced Signal Conditioning Unit	ASCUFDD-WCDMA	R & S
ETS 0395	Universal Protocol Tester	CRTU-G	R & S
ETS 0396	Protocol Slave	CRTU-S	R & S
ETS 0397	Protocol Slave	CRTU-S	R & S
ETS 0398	Fading Simulator	ABFS	R & S
ETS 0399	Univ. Protocol Tester (Protocol Unit) (Radio Unit)	CRTU-W (CRTU-PU) (CRTU-RU)	R & S
ETS 0400	Univ. Protocol Tester (Protocol Unit) (Radio Unit)	CRTU-W (CRTU-PU) (CRTU-RU)	R & S
ETS 0401	MPEG2 Generator	DVG	R & S
ETS 0402	TV Messenger	SFQ	R & S
ETS 0403	RF Current Probe	F-140	FCC
ETS 0404	Exposure Level Tester	ELT-400	Narda
ETS 0405	Magnetic Field Probe 100 cm ²	2300/90.10	Narda
ETS 0406	Signal Generator	SML 02	R & S
ETS 0407	EMC Emissions tester	Harmonics 1000	EMC Partner
ETS 0408	Transient 2000	TRA1Z191N	EMC Partner
ETS 0409	Stripline	DC220	Schwarzbeck
ETS 0410	BAN	1	ETS
ETS 0411	Universal Protocol Tester	CRTU-G	R & S
ETS 0412	Spectrum Analyzer	FSU 3	R & S
ETS 0413	Signal Analyzer	FSIQ 26	R & S
ETS 0416	Power Supply	EX752M	TTi
ETS 0417	Beacon Tester	BT100S	WS Tech. Inc.
ETS 0418	High pass filter 4 - 8 G		Microwave
ETS 0419	High pass filter 8 - 18 G		Microwave
ETS 0420	Amplifier 0.1-1 GHz	M/N AM-1331	MITEQ
ETS 0421	Amplifier 1-4 GHz	AFD3-010040-15-LN	MITEQ
ETS 0422	Amplifier 4-8 GHz	DBS-0408N423	Narda
ETS 0423	Amplifier 8-18 GHz	DWT-18057	Narda
ETS 0424	Amplifier 18-26.5 GHz	DBS-1826N515	Narda
ETS 0425	T-Artificial Mains Network	ESH3-Z4	R & S
ETS 0426	CDN	T4 HF	MEB
ETS 0427	Power sensor	NRV-Z6	R & S
ETS 0428	4-WIRE ISN with B1	ENY41	R & S
ETS 0429	Current Probe Test Jig	SW14 7LY	Chase
ETS 0430	Signal Generator	SML02	R&S
ETS 0431	AC Mains Adaptor	BS5733	Travel Emporium
ETS 0432	RF amplifier matrix	RSU-ETS-BT	ETS
ETS 0433	RF amplifier matrix	RSU-ETS-CTR6	ETS

Test Report No.: G0M20801-0415-C-1

No.	Test equipment	Type	Manufacturer
ETS 0435	HP-Filter	H1G04G01	Microwave
ETS 0436	HP-Filter	H1G04G01	Microwave
ETS 0437	HP-Filter	H04G08G1	Microwave
ETS 0438	HP-Filter	H0G408G1	Microwave
ETS 0439	Amplifier	DBS-1826N515	Narda-DBS-Microwave
ETS 0440	Amplifier	AM-1331	MITEQ
ETS 0441	Bluetooth Protocol Tester	PTW 60	R & S
ETS 0445	RF-Attenuator 6dB	50FH-006-300	JFK
ETS 0446	RF-Attenuator 30dB	50FH-030-300	JFK
ETS 0447	Artificial Mains Network	LN-KFZ/200	Heine
ETS 0448	RF Power Amplifier	AR 60S1G3	AR Amplifier Research
ETS 0449	Stäubli Robot	RX90B L	Stäubli
ETS 0450	Stäubli Robot Controller	CS/MBs&p	Stäubli
ETS 0451	DASY 4 Measurement Server		Schmid & Partner
ETS 0452	Control Pendant		Stäubli
ETS 0453	Compaq Computer	Pentium IV, 2GHz	Schmid & Partner
ETS 0454	Data Acquisition Electronics	DAE3V1	Schmid & Partner
ETS 0455	Dummy Probe		Schmid & Partner
ETS 0456	Dosimetric E-Field Probe	ET3DV6	Schmid & Partner
ETS 0457	Dosimetric E-Field Probe	ET3DV6	Schmid & Partner
ETS 0458	Dosimetric H-Field Probe	H3DV6	Schmid & Partner
ETS 0459	System Validation Kit	D900V2	Schmid & Partner
ETS 0460	System Validation Kit	D1800V2	Schmid & Partner
ETS 0461	System Validation Kit	D1900V2	Schmid & Partner
ETS 0462	System Validation Kit	D2450V2	Schmid & Partner
ETS 0463	Probe Alignment Unit	LBV2	Schmid & Partner
ETS 0464	SAM Twin phantom	V 4.0	
ETS 0465	Mounting Device	V 3.1	
ETS 0466	Directional Coupler	HP 87300B	HP
ETS 0467	Oval flat phantom	ELI 4	Schmid & Partner
ETS 0468	Isotropic E-Field Probe	ER3DV6	Schmid & Partner
ETS 0469	Dielectric Probe Kit	85070D	Agilent
ETS 0470	Amplifier	AM-1300-1103	withEQ
ETS 0472	Antenna	BTA-H	Frankonia
ETS 0473	GSM / UMTS System Simulator	TS 8950	R&S
ETS 0474	EMI Test Receiver	ESCS 30	R&S
ETS 0475	Amplifier	AFS4-00101800-U	withEQ
ETS 0476	EMI Test receiver	ESCS 30	R&S
ETS 0477	GPS-System (active GPS-antenne)	4490	HOPF
ETS 0478	Crystal filter	MQF 127.50-2400/F	Vectron International
ETS 0479	System Validation Dipoles	D300V3	Schmid & Partner
ETS 0480	System Validation Dipoles	D450V3	Schmid & Partner

No.	Test equipment	Type	Manufacturer
ETS 0481	40GHz Standard Gain Horn with Amplifier	22240-25 CBL26402075	Flann Microwave
ETS 0482	40GHz High Gain Antenna	AT4560	Amplifier research
ETS 0483	Amplifier	AFD3010040-15-LN	MITEQ
ETS 0484	Radio Communication Tester	CMU 200	R&S
ETS 0485	Radio Communication Tester	CMU 200	R&S
ETS 0486	Circular polarized antenna	3101L	EMCO
ETS 0487	Torso simulator		ETS
ETS 0488	EMI Test Receiver	ESHS10	R & S
ETS 0489	Rubidium Frequency Standard	MFS	DATUM
ETS 0490	Rubidium Frequency Standard	8040	DATUM
ETS 0491	RF Distribution	DATUM 6502	DATUM
ETS 0492	Industrial Controller	PSM12	R & S
ETS 0493	Protokoll Tester	PTW60	R & S
ETS 0494	Switching unit	SSCU	R & S
ETS 0495	RF Step Attenuator	RSP	R & S
ETS 0496	Spectrum Analyzer	FSP	R & S
ETS 0497	Power Meter	NRVD	R & S
ETS 0498	Diode Power Sensor	NRV-Z1	R & S
ETS 0499	Diode Power Sensor	NRV-Z1	R & S
ETS 0500	Signal Generator	SMIQ03	R & S
ETS 0501	Signal Generator	SMIQ03	R & S
ETS 0502	Power Splitter	DS-808-4	Macom
ETS 0503	Directional Coupler	IAW	Microwave Filter Company
ETS 0504	AMTS-Simulator A	Feeding Bridge A	Emmerich
ETS 0505	Diode Power Sensor	NRV-Z1	R & S
ETS 0506	Diode Power Sensor	NRV-Z6	R & S
ETS 0507	Power Divider	PS-Z101-4S	UMCC
ETS 0508	Power Divider	T-1000	Macom
ETS 0509	Power Divider	T-1000	Macom
ETS 0510	Power Divider	T-1000	Macom
ETS 0511	Power Divider	DS-409-4	Anzac
ETS 0512	Log Periodical Antenna	HL 025	R & S
ETS 0513	Flat Phantom	V4.4	Schmid & Partner
ETS 0514	Limiting amplifier	APT55-00100200-500-D66	Amplitech
ETS 0515	Limiting amplifier	APT55-00100200-500-D66	Amplitech

2.4 General test procedure

POWER LINE CONDUCTED INTERFERENCE: The procedure used was ANSI STANDARD C63.4-2003 5.2 using a 50 μ H LISN (if necessary). Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.4-2003 6.4 using a spectrum analyzer. The resolution bandwidth of the spectrum analyzer was 100 kHz for measurements below 1 GHz and RBW 1 MHz was used above 1 GHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

FORMULA OF CONVERSION FACTORS for Field strength: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB μ V) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB.

Example:

Freq. (MHz)	METER READING + ACF + CABLE LOSS (to the receiver) = FS
33	20 dB μ V + 10.36 dB + 6 dB = 36.36 dB μ V/m @3m

ANSI STANDARD C63.4-2003 6.2.1 MEASUREMENT PROCEDURES: The UUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m (non metallic table). The UUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 30 MHz to at least 10th harmonic of the fundamental.

Peak readings were taken in three (3) orthogonal planes and the highest readings.

Measurements were made by Eurofins ETS Product Service GmbH at the registered open field test site located at Storkower Str. 38c, 15526 Reichenwalde, Germany.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

ANTENNA & GROUND:

This unit uses internal antenna.

3 Test results

☒ 1st test

☐ test after modification

☐ production test

SECT.	TEST CASE	FCC 47CFR PART	IC RSS-	Required	Test passed	Test failed
3.1	<i>TRANSMITTER PARAMETERS</i>					
3.1.1	RF power output, conducted	15.247 (b)(3)	210 A8.4	☒	☒	☐
3.1.2	RF power output, radiated (EIRP)	15.247 (b)(3)	210 A8.4	☐	☐	☐
3.1.3	6 dB bandwidth	15.247 (a)(2)	210 A8.2	☒	☒	☐
3.1.4	Peak power spectral density	15.247 (e)	210 A8.2	☒	☒	☐
3.1.5	Spurious emissions, conducted	15.247 (d)	210 A8.5	☐	☐	☐
3.1.6	Spurious emissions, radiated	15.247 (d)	210 A8.5	☒	☒	☐
3.1.7	AC power line conducted emissions	15.207	Gen 7.2.2	☒	☒	☐
3.2	<i>RECEIVER PARAMETERS</i>					
3.2.1	Spurious emissions	-	Gen 7.2.3	☒	☒	☐

3.1 Transmitter parameters

3.1.1 RF power output, conducted

Reference

FCC	47 CFR part 15.247 (b)
IC	RSS-210 A 8.4

Method of measurement

This measurement applies to equipment with an integral antenna and to equipment with an antenna connector and equipped with an antenna as declared by the applicant.

The power was measured with modulation (declared by the applicant).

Limits

FCC	1 Watt (30dBm)
IC	1 Watt (30dBm)

Test results

Test conditions	Channel B
$T_{nom} = 25\text{ }^{\circ}\text{C}$ $V_{nom} = 2.5\text{ V}$	1.17 dBm
$T_{nom} = 25\text{ }^{\circ}\text{C}$ $V_{min} = 2.3\text{ V}$	1.04 dBm
$T_{nom} = 25\text{ }^{\circ}\text{C}$ $V_{max} = 2.7\text{ V}$	1.25 dBm
Measurement uncertainty	< 3 dB

Test equipment: ETS 0253, ETS 0271

3.1.2 RF power output, radiated (EIRP)

Reference

FCC	CFR part 15.247 (b)(3)
IC	RSS-210 A8.4

Method of measurement

This measurement applies to equipment with an integral antenna and to equipment with an antenna connector and equipped with an antenna as declared by the applicant.

The power was measured with modulation (declared by the applicant).

Limits

FCC	1 Watt (30dBm)
IC	1 Watt (30dBm)

Test Results

Test conditions	Frequency 1	Frequency 2	Frequency 3
	EIRP [dBm]	EIRP [dBm]	EIRP [dBm]
$T_{nom} = 25\text{ }^{\circ}\text{C}$ $V_{nom} = 2.5\text{ V}$	--	--	--
Measurement uncertainty	< 3 dB		

Comment: Not required.

Test equipment:--

3.1.3 6 dB bandwidth; Occupied bandwidth (99% BW)

Reference

FCC	CFR part 15.247 (a)(2)
IC	RSS-210 A8.2, RSS-Gen 4.4.1

Method of measurement

Spectrum analyser for 6 dB bandwidth:

RBW: 100 kHz

Span: VBW > RBW

Spectrum analyser for Occupied bandwidth:

99 % emission bandwidth

Limits

FCC	$BW_{6dB} \geq 500 \text{ kHz}$
IC	$BW_{6dB} \geq 500 \text{ kHz}$
IC	Occupied BW no limit

Test results

Test conditions	Channel B
<u>6 dB BW</u>	
$T_{nom} = 25 \text{ }^{\circ}\text{C}$ $V_{nom} = 2.5 \text{ V}$	55.770467 MHz
<u>Occupied BW</u>	
$T_{nom} = 25 \text{ }^{\circ}\text{C}$ $V_{nom} = 2.5 \text{ V}$	59.455128 MHz
Measurement uncertainty	< 10 Hz

System receiver input bandwidth:

The manufacturer declares that the receiver input bandwidth matches to the bandwidth of the transmitter signal.

Test equipment: ETS 0271

3.1.4 Peak power spectral density

Reference

FCC	CFR part 15.247 (e)
IC	RSS-210 A8.2

Method of measurement

The same method of determining the conducted output power shall be used to determine the power spectral density.

Spectrum analyser for Peak power spectral density:

span: RBW = 3 kHz
 VBW > RBW
 Sweep = span/3 kHz

Limits

FCC	≤ 8 dBm in any 3kHz band
IC	≤ 8 dBm in any 3kHz band

Test results

Test conditions	Peak Power Spectral Density
	Channel B
$T_{nom} = 25\text{ °C}$ $V_{nom} = 2.5\text{ V}$	-29.07 dBm
Measurement uncertainty	< 3 dBs

Test equipment: ETS 0271

3.1.5 Spurious emissions, conducted

Reference

FCC	CFR part 15.247 (d)
IC	RSS-210 A8.5

Method of measurement

The EUT is connected to the spectrum analyzer via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT is switched on, the hopping function is disabled.

The analyzer setting was as following:

Frequency range	RES bandwidth		Video bandwidth	
	Pk	Avg	Pk	Avg
f < 1GHz	100 kHz	-	100 kHz	-
f > 1GHz	1 MHz	1 MHz	1 MHz	1MHz

Limits

FCC	20 dB below peak output power
IC	20 dB below peak output power

Test results

Frequency	Result [dBm]	Limit [dBm]	Margin [dB]	Reference level [dBm]
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

Comment: Not required.

Test equipment: --

Test Report No.: G0M20801-0415-C-1

3.1.6 Spurious emissions, radiated

Reference

FCC	CFR part 15.247(d), 15.205, 15.209, 15.35
IC	RSS-210 A8.5

Method of measurement

Spurious emissions were measured with modulation (declared by manufacturer).

According to 47 CFR 15, Part 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a) (see Section 15.205(c)).

Sample Calculation of Limit:

All results are updated by an automatic measuring system in accordance to point 2.3

Limit = max. reading (because peak detector is used)
77.05 dB μ V/m

Limit = Max. reading - 20 dB (because average detector is used)
77.05 dB μ V/m - 20 dB = 57.05 dB μ V/m

Calculation of test results:

Such factors like antenna correction, cable loss, external attenuation etc. are already included in the provided measurement results.

The peak and average spurious emissions plots were measured with the average limits.
In the Table being listed the critical peak and average value an exhibit the compliance with the above calculated Limits.

If in the column's correction factor states a value then the max. Field strength in the same row is corrected by a value gained from the "Marker-Delta-Method" or the „Duty-Cycle Correction Factor“.

15.35 (c) average value

When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle correction = $20 \log (\text{dwell time} / \text{pulse-train time of 100 ms or less})$

The radiated emissions measurements were performed from 30 MHz to 26000 MHz.

The analyzer setting was as following:

Frequency range	RES bandwidth		Video bandwidth	
	Pk	Avg	Pk	Avg
f < 1GHz	100 kHz	-	100 kHz	-
f > 1GHz	1 MHz	1 MHz	1 MHz	1MHz

Limits

FCC	20 dB below peak output power, emissions which fall in the restricted bands (15.205(a)) must comply the following limits:		
	Frequencies below 1GHz:		
	Frequency of emissions [MHz]	Field strength [μV / m]	Field strength [dBμV / m]
	30 – 88	100	40.0
	88 – 216	150	43.5
	216 – 960	200	46.0
	Above 960	500	54.0
IC	For frequencies above 1 GHz (Avg measurements): 54.0 dBμV / m		
	For frequencies above 1 GHz (Pk measurements):		
	Limit + 20 dB = 54.0 dBμV / m + 20 dB = 74 dBμV / m		
IC	20 dB below peak output power, emissions which fall in the restricted bands of table 1 (RSS-210 §2.7) must also comply with limits specified in tables 2 and 3		

Test results

Summary table with radiated data of the test plots

Freq.	Used Ch.	Frequency Marker [GHz]	Polarization	Δ corrections dB	Max. Field Strength [dB μ V/m]	Compliance Limit [dB μ V/m]	Detector	BW [MHz]	Margin [dB]
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--

Freq. – Frequency Range:

1:	30	–	200 MHz
2:	200	–	1000 MHz
3:	1	–	4 GHz
4:	4	–	8 GHz
5:	8	–	12 GHz
6:	12	–	17 GHz
7:	17	–	26.5 GHz

Comment: All other not noted test plots do not contain significant test results in relation to the limits.

Please see attached diagrams.

Test equipment: ETS 0012, ETS 0013, ETS 0015, ETS 0018, ETS 0271, ETS 0253, ETS 0311

3.1.7 AC power line conducted emissions

Reference

FCC	CFR part 15.207
IC	RSS-Gen 7.2.2

Method of measurement

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

This measurement was transact first with instrumentation using an average and peak detector and a 10 kHz bandwidth. If the peak detector achieves a calculated level, the measurement is repeated by an instrumentation using a quasi-peak detector.

Limits

FCC & IC	Frequency of emissions	Conducted limit field strength [dB μ V]	
	[MHz]	Quasi Peak	Avg
	0.15 - 0.5	66 to 56	56 - 46
	0.5 - 5	56	46
	5 - 30	60	50

Test results

Frequency	Level	
	Quasi-peak	Average
150 kHz	Lower limit line	Lower limit line

Comment: See attached diagrams.

Test equipment: ETS 0288, ETS 0474

3.2 Receiver parameters

3.2.1 Spurious emissions

Reference

FCC	-
IC	RSS-Gen 7.2.3

Method of measurement

The compliance of the EUT Receiver with the Limits of spurious emissions was performed according to the radiated measurement method.

The spectrum analyzer RBW was set to 100 kHz for measurements below 100 kHz and 1.0 MHz above 1.0 GHz. The measurement results are evaluated according to the procedure described in section 2.4 of this test report.

Limits:

	Spurious frequency	Field strength
	MHz	microvolt/m at 3 meter
FCC & IC	30 - 88	100
	88 - 216	150
	216 - 960	200
	above 960	500

Test Results

	Frequency marker indication [MHz]	Antenna polarization	Worst case emissions level [μV/m]	Compliance limit [μV/M]	Results
	190,802		41,02	150	<u>-108,98</u>
	198,297		40,04	150	<u>-109,96</u>
	977,555		16,90	200	<u>-183,10</u>
	977,555		15,61	200	<u>-184,39</u>
	3922,000		124,17	500	<u>-375,83</u>
	3880,000		121,20	500	<u>-378,80</u>
	7551,000		139,16	500	<u>-360,84</u>
	7912,000		156,31	500	<u>-343,69</u>

Comment: Please see attached diagrams.

Test equipment: ETS 0014, ETS 0294, ETS 0295, ETS 0310, ETS 0416, ETS 0484

Test Report No.: G0M20801-0415-C-1

Eurofins ETS Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

Appendix

- A Pictures
- B Spurious emissions radiated
- C AC power line conducted
- D Receiver spurious emissions