2.5.3 Performance test results with reference to each clause of the specification

7 EN Transmitter tests
7.1 EN Protection of the transmitter

Test conditions:	TX frequency	f 1	=	127.500	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.8	V
	Extreme power supply	U DC	=	10.8 – 16.1	V
	Normal temperature	t	=	23.0	°C
	Test set-up: 1				

Test performance at RF-output	Duration (sec)	Test results
Short circuit	60	No degradation
Open circuit	60	No degradation

Limits kept : **Yes** [X] **No** [ ]

7.2 EN Frequency error
87.133 FCC Frequency stability

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Normal power supply	U DC	=	13.8	V
	Extreme power supply	U DC	=	10.8 – 16.1	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	Test set-up: 1				

Limits

Equipment	Normal temperature	Extreme temperature
EN: 25 kHz Fixed/base	<±5.0 ppm	<±10.0 ppm
EN: 25 kHz Mobile/portable	<±10.0 ppm	<±15.0 ppm
FCC	<±20.0 ppm	<±20.0 ppm

Test results

TX-frequency (MHz)	t (°C)	U (V)	Measured frequency (MHz)	Frequency Error (Hz)	Frequency error (ppm)
118.000 000	23.0	10.8	117.999 930	-70	-0.6
118.000 000		13.8	117.999 930	-70	-0.6
118.000 000		16.1	117.999 930	-70	-0.6
127.500 000		10.8	127.499 875	-125	-1.0
127.500 000		13.8	127.499 875	-125	-1.0
127.500 000		16.1	127.499 875	-125	-1.0
136.975 000		10.8	136.974 975	-25	-0.2
136.975 000		13.8	136.974 975	-25	-0.2
136.975 000		16.1	136.974 975	-25	-0.2
118.000 000	55.0	10.8	117.999 450	-550	-4.7
118.000 000		16.1	117.999 450	-550	-4.7
127.500 000		10.8	127.499 410	-590	-4.6
127.500 000		16.1	127.499 410	-590	-4.6
136.975 000		10.8	136.974 710	-390	-2.1
136.975 000		16.1	136.974 710	-390	-2.1
118.000 000	-20.0	10.8	118.000 650	650	+5.5
118.000 000		16.1	118.000 780	780	+6.6
127.500 000		10.8	127.500 850	850	+6.7
127.500 000		16.1	127.500 830	830	+6.5
136.975 000		10.8	136.975 880	880	+6.4
136.975 000		16.1	136.975 880	880	+6.4

Remarks: With external power supply U DC ≤ 11.0 V the EUT display indication **dc** starts flashing

Limits kept : **Yes** [X] **No** [ ]

7.3 EN Carrier power
87.131 FCC Power and emissions

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation	m	=	Modulation off	
	Normal power supply	U DC	=	13.8	V
	Extreme power supply	U DC	=	10.8 – 16.1	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	Rated output power	**p**	**=**	**37.0**	**dBm**
	Test set-up: 1				

Tolerances; limits

Equipment	Normal temperature	Extreme temperature
EN: 25 kHz	Output power (x dBm)± 1.5 dB	x dBm +1.5 dB to –3.0 dB
FCC 25 kHz mobile device	10.0 W	10.0 W
FCC 25 kHz fixed device	50.0 W	50.0 W

Test results See plot 01

TX-frequency (MHz)	t (°C)	U DC (V)	Output pwr. p (dBm)	Tolerance (dB)
118.000 000	23.0	10.8	37.6	0.6
118.000 000		13.8	37.7	0.7
118.000 000		16.1	37.7	0.7
127.500 000		10.8	37.4	0.4
127.500 000		13.8	37.5	0.5
127.500 000		16.1	37.5	0.5
136.975 000		10.8	37.6	0.6
136.975 000		13.8	37.7	0.7
136.975 000		16.1	37.7	0.7
118.000 000	55.0	10.8	37.3	0.3
118.000 000		16.1	37.4	0.4
127.500 000		10.8	37.2	0.2
127.500 000		16.1	37.3	0.3
136.975 000		10.8	37.3	0.3
136.975 000		16.1	37.3	0.3
118.000 000	-20.0	10.8	37.7	0.7
118.000 000		16.1	37.8	0.8
127.500 000		10.8	37.2	0.2
127.500 000		16.1	37.4	0.4
136.975 000		10.8	37.5	0.5
136.975 000		16.1	37.7	0.7

Remarks: With external power supply U DC ≤ 11.0 V the EUT display indication **dc** starts flashing

Limits kept : **Yes** [X] **No** [ ]

7.4.1 EN Modulation depth
87.141 FCC Modulation requirements

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	1 000	Hz
	Modulation depth	m	=	85.0	%
	Normal power supply	U DC	=	13.8	V
	Extreme power supply	U DC	=	10.8 – 16.1	V
	Normal temperature	t n	=	23.0	°C
	Extreme temperature	t min	=	-20.0	°C
	Extreme temperature	t max	=	55.0	°C
	Test set-up: 1				

Limits

Equipment	Normal temperature	Extreme temperature
EN: 25 kHz	m = 85.0 %	m = 80.75 % to 90.25 %
FCC 25 kHz	m = < 100 %	m = < 100 %

Test results

TX-frequency (MHz)	t (°C)	U (V)	AF = 1000Hz U eff (mV)	m (%)	See plot No.
118.000 000	23.0	10.8	125	85.0	02
118.000 000		13.8	125	85.0	
118.000 000		16.1	125	85.0	
127.500 000		10.8	107	85.0	03
127.500 000		13.8	107	85.0	
127.500 000		16.1	107	85.0	
136.975 000		10.8	122	85.0	04
136.975 000		13.8	122	85.0	
136.975 000		16.1	122	85.0	
118.000 000	55.0	10.8	93	85.0	05
118.000 000		16.1	95	85.0	
127.500 000		10.8	88	85.0	06
127.500 000		16.1	90	85.0	
136.975 000		10.8	90	85.0	07
136.975 000		16.1	90	85.0	
118.000 000	-20.0	10.8	135	85.0	08
118.000 000		16.1	135	85.0	
127.500 000		10.8	100	85.0	09
127.500 000		16.1	100	85.0	
136.975 000		10.8	125	85.0	10
136.975 000		16.1	125	85.0	

Remarks: With external power supply U DC ≤ 11.0 V the EUT display indication **dc** starts flashing

Limits kept : **Yes** [X] **No** [ ]

7.4.2 EN Modulation compression

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	1000	Hz
	Modulation depth	m	=	10 % to 30 % to 85	%
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 1				

7.4.2.3 EN Limits

AF level increase (dB)	Modulation change (%)
10.0 (± 2.0)	10 to 30
9.0 (± 2.0)	30 to 85
20.0 (± 2.0)	max 95

Test results

TX-frequency (MHz)	U eff (mV) 100 to 2500 Hz	m (%)	U eff (mV) +16 dB	m (%)	F min (MHz) –23.0 dBc	F max (MHz) –23.0 dBc
118.000 000	26.2	50.0	165.2	86.5	117.997	118.003
127.500 000	26.5	50.0	167.3	88.0	127.498	127.503
136.975 000	26.0	50.0	164.0	88.9	136.973	136.977

TX-frequency (MHz)	U eff (mV) AF white noise	m (%)	F min (MHz) –23.0 dBc	F max (MHz) –23.0 dBc
118.000 000	200	87.6	117.997	118.003
127.500 000	200	88.0	127.497	127.503
136.975 000	200	90.5	136.972	136.978

Limits kept : **Yes** [X] **No** [ ]

7.4.3 EN Amplitude modulation distortion
87.141 FCC Modulation requirements

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	1000	Hz
	Modulation depth	m	=	85	%
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C

Test set-up: 1

7.4.3.3 EN Limits

Max. modulation (%)	Max. distortion (%)
85.0 to 95.0	10.0
FCC < 100 %	

Test results

TX-frequency (MHz)	AF U eff (mV)	m (%)	distortion d (%)	U eff (mV) +3 dB	m (%)	distortion d (%)
118.000 000	25.8	50.0	2.5	177	85.5	8.6
127.500 000	26.0	50.0	2.4	133	87.0	4.9
136.975 000	26.6	50.0	3.1	172	85.4	8.9

Limits kept : **Yes** [X] **No** [ ]

7.4.4 EN Audio frequency response
87.137 FCC Types of emission

Test conditions:	TX frequency	f	=	127.500	MHz
	Modulation frequencies	f m	=	100 Hz to 10 000	Hz
	Modulation depth	m	=	60	%
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 1				

7.4.3.3 EN Limits

Equipment	AF range (Hz)	Modulation (%)	Max. mod. ratio (dB)
25 kHz base/mobile	300 to 3400	60.0	+2.0 / -4.0
25 kHz portable	350 to 2500	60.0	+2.0 / -4.0

Audio frequency (kHz)	Const. AF input m (%)	Mod. ratio (dB)
0.100	-	>-30.0
0.200	+9.0	-8.23
0.300	**+28.5**	**-3.23**
0.350	**+37.5**	**-2.04**
0.400	+44.6	-1.29
0.600	+55.0	-0.38
0.800	+56.7	-0.24
1.000	**60.0**	**(ref) 0.0**
1.200	+60.9	+0.03
1.400	63.6	+0.25
1.600	64.5	+0.31
1.800	64.5	+0.31
2.000	64.1	+0.29
2.500	**58.0**	**-0.15**
3.000	52.8	-0.55
3.200	54.7	-0.40
3.400	**38.2**	**-1.96**
3.500	23.8	-4.02
4.000	1.5	-16.02
4.500	0.5	-20.79
5.000	**0.4**	**-21.76**
6.000	-	<-30.0
10.000	-	<-30.0

Limits kept : **Yes** [X] **No** [ ]

7.5 EN Adjacent channel power (ACP)

Test conditions:

TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
Modulation frequency	f m	=	1000	Hz
Modulation depth	m	=	85	%
Normal power supply	U DC	=	13.8	V
Normal temperature	t n	=	23.0	°C

Test set-up: 1

Limits

Specification	Modulation (%)	Carrier offset (kHz)	ACP (dBc)
EN	85.0	±25.0	>-60.0
FCC	>50.0	±25.0	>-60.0

Test results

TX-frequency (MHz)	m (%)	AF input (mV)	TX -25 kHz ACP (dBc)	TX +25 kHz ACP (dBc)	See plot No.
118.000 000	85.0	125	-76.2	-76.0	11
127.500 000	85.0	87	-77.2	-80.7	12
136.975 000	85.0	162	-67.2	-69.5	13

Limits kept : **Yes** [X] **No** [ ]

7.7 EN Conducted spurious emissions (TX active)
87.139 FCC Emission limitations

Test conditions:	TX frequency	f	=	118.000	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2				

EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	100.0
1 000 – 4 000	-47.0	-30.0	-40.0	1 000.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
118.000	177.000 to 295.000	30.0
	295.000 to 413.000	38.0
	413.000 to 980.000	53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Level (dBm)	Attenuation (dBc)	Remarks	See plot No. :
0.009 – 0.150	n.f.	0.3	<-54.0	>91.0	noise	20
0.150 – 30.000	n.f.	10.0	<-50.0	>87.0	noise	21
30.000 – 1 000.000	118.000	100.0	-4.0	33.5	TX + notch	22
	236.000	100.0	-47.8	85.3	2. harmonic	22
	354.000	100.0	-49.2	86.7	3. harmonic	22
	472.000	100.0	-63.2	100.7	4. harmonic	22
68.000 – 168.000	102.045	30.0	-48.3	85.5	spurious	23
	118.000	30.0	-3.8	41.3	TX + notch	23
	133.845	30.0	-46.8	84.3	spurious	23
1 000 – 4 000	n.f.	1 000.0	<-44.0	>81.5	noise	24
4.0 – 10.0 GHz	n.f.	1 000.0	<-48.0	>85.5	noise	25

n.f.= nothing found

Limits kept : **Yes** [X] **No** [ ]

7.7 EN Conducted spurious emissions (TX active)
87.139 FCC Emission limitations

Test conditions:	TX frequency	f	=	127.500	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 2				

7.7.3 EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	100.0
1 000 – 4 000	-47.0	-30.0	-40.0	1 000.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
127.500	191.250 to 318.750	30.0
	318.750 to 446.250	38.0
	446.250 to 980.000	53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Level (dBm)	Attenuation (dBc)	Remarks	See plot No. :
0.009 – 0.150	n.f.	0.3	<-54.0	>91.5	noise	20
0.150 – 30.000	n.f.	10.0	<-50.0	>87.5	noise	21
30.000 – 1000.000	127.500	100.0	5.0	32.5	TX + notch	26
	255.000	100.0	-51.3	88.8	2. harmonic	26
	381.000	100.0	-48.2	85.7	3. harmonic	26
67.500 – 177.500	111.050	30.0	-50.8	88.3	spurious	27
	127.500	30.0	5.0	32.5	TX + notch	27
	143.650	30.0	-52.4	89.9	spurious	27
1 000 – 4 000	n.f.	1000.0	<-44.0	>81.0	noise	24

n.f.= nothing found

Limits kept : **Yes** [X] **No** [ ]

7.7 EN Conducted spurious emissions (TX active)
87.139 FCC Emission limitations

Test conditions:	TX frequency	f	=	136.975	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C

Test set-up: 2

7.7.3 EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	TX active Harmonics (dBm)	TX active Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	not applicable	-46.0	1.0
0.150 – 30.000	-57.0	not applicable	-46.0	10.0
30.000 – 1 000	-57.0	-36.0	-46.0	100.0
1 000 – 4 000	-47.0	-30.0	-40.0	1 000.0

FCC Limits

Wanted frequency (MHz)	Spurious frequency ranges (MHz)	Attenuation (dBc)
136.975	205.463 to 342.438	30.0
	342.438 to 479.413	38.0
	479.413 to 980.000	53.0

Test results:

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	Level (dBm)	Attenuation (dBc)	Remarks	See plot No. :
0.009 – 0.150	n.f.	0.3	<-54.0	>91.5	noise	20
0.150 – 30.000	n.f.	10.0	<-50.0	>87.5	noise	21
30.000 – 1000.000	136.975	100.0	4.0	33.5	TX + notch	28
	273.950	100.0	-53.2	90.7	2. harmonic	28
	410.925	100.0	-49.8	87.3	3. harmonic	28
87.000 – 187.000	119.600	30.0	-47.3	84.8	spurious	29
	136.975	30.0	5.0	32.5	TX + notch	29
	147.200	30.0	-55.0	92.5	spurious	29
1 000 – 4 000	n.f.	1000.0	<-75.0	>81.0	noise	24

n.f.= nothing found

Limits kept : **Yes** [X] **No** [ ]

8.10 EN Conducted spurious emissions (RX active)
15.107 FCC General requirements for unintentional radiators (Conducted emissions)

Test conditions:	RX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 3				

8.10.3 EN Limits

Frequency range (MHz)	TX stand by Spurious (dBm)	Resolution BW (kHz)
0.009 – 0.150	-57.0	1.0
0.150 – 30.000	-57.0	10.0
30.000 – 1 000	-57.0	100.0
1 000 – 4 000	-47.0	1 000.0

FCC Limits Class B

Frequency (MHz)	RF voltage (µV)	RF voltage (dBµV)
0.450 – 30.000	250	47.9

Test results: measurements at antenna port with MAX HOLD

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	RF level (dBm)	RF voltage (dBµV)	Remarks	See plot No. :
0.009 – 0.150	n.f.	1.0	<-88.0	<19.0	noise	30
0.150 – 30.000	n.f.	10.0	<-85.0	<22.0	noise	31
30.000 – 1000.000	749.40	100.0	-84.2	22.8		32
1.000 – 4.000 GHz	n.f.	1000.0	<-73.0	<34.0	noise	33

Test results: measurements at DC power supply port with MAX HOLD

Frequency range (MHz)	Spurious (MHz)	Res BW (kHz)	RF voltage (dBµV)	Remarks	See plot No. :
0.450 – 30.000	7.150	10.0	26.0	Plus / Minus	34

Test standards passed: **Yes** [X] **No** [ ]

15.109 FCC General requirements for unintentional radiators (Radiated limits)

Test conditions:	RX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 4				

FCC Limits Class B

Frequency (MHz)	Field strength E (µV/m)	Field strength e (dBµV/m) @ 3.0 m	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	88.5 ... 53.8	300
0.490 – 1.705	24000/F(kHz)	53.8 ... 43.0	30
1.705 – 30.0	30	49.5	30
30 - 88	100	40.0	3
88 – 216	150	43.5	3
216 - 960	200	46.0	3
above 960	500	54.0	3

Test results: measurements at 3.0 m distance with MAX HOLD

Frequency band	Measured spurii (MHz)	e (dBµV/m)	E (µV/m)	See Plot No
0.009 ... 30.000 MHz	n.f.	<30.0	<31.62	35
30 MHz – 4.000 GHz	n.f.	<38.0	<79.5	36/37/38

Test standards passed: **Yes** [X] **No** [ ]

15.207 FCC General requirements for intentional radiators (Conducted limits)

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Normal power supply	U DC	=	13.80	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 3				

FCC Limits

Frequency (MHz)	RF voltage (µV)	RF voltage (dBµV)
0.450 – 30.000	250	47.9

Test results: measurements at DC power supply port with MAX HOLD

Frequency band	Spurious (MHz)	u (dBµV)	U (µV)	See Plot No
0.450 ... 30.000 MHz	2.250	28.7	27.227	39

Test standards passed: **Yes** [X] **No** [ ]

15.209 FCC General requirements for intentional radiators (Radiated limits)

Test conditions:	TX frequencies	f	=	118.000 / 127.500 / 136.975	MHz
	Modulation frequency	f m	=	No modulation	
	Normal power supply	U DC	=	13.8	V
	Normal temperature	t n	=	23.0	°C
	Test set-up: 3				

Limits

Frequency (MHz)	Field strength E (µV/m)	Field strength e (dBµV/m) @ 3.0 m	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	88.5 ... 53.8	300
0.490 – 1.705	24000/F(kHz)	53.8 ... 43.0	30
1.705 – 30.0	30	49.5	30
30 - 88	100	40.0	3
88 – 216	150	43.5	3
216 - 960	200	46.0	3
above 960	500	54.0	3

Measurements at 3.0 m distance

Frequency band (MHz)	Spurious No.	Measured spurii (MHz)	e (dBµV/m)	E (µV/m)	Plot No
0.009 ... 30.000	-	n.f.	<50.0	-	40
30.000 – 4,000	1	118.000	72.0 *)	Wanted frq.	41
30.000 – 4,000	1	127.500	60.0 *)	Wanted frq.	42
30.000 – 4,000	1	136.975	65.0 *)	Wanted frq.	43
4,000 – 10,000	1	7390	Noise	-	25

*) Remark: Transmitter is terminated by a non-reactive load

Test standards passed: **Yes** [X] **No** [ ]