



CE-Mesures

Rapport d'essais / Test Report

N° : 20721-FCC-1

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SMEE

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FCC Registration Number: 0020356952 (FRN) Test Firm Registration Number: 171131

IC Company Number: 9545A

Matériel testé :
Equipment under test:

MUZIK Smart On Ear (Wireless headphones) / MZHP1

Constructeur:
Manufacturer:

Muzik LLC
404 Washington Ave. #700
Miami Beach, FL 33139 – USA

Rapport délivré à :
Issued to:

Muzik LLC
404 Washington Ave. #700
Miami Beach, FL 33139 – USA

Référence de la proposition :
Proposal number:

092013-20721

Date de l'essai :
Date of test:

September 4th to 6th, 2013

Objectif des essais :
Test purpose:

Qualification FCC suivant les normes :
FCC qualification according to standards:
CFR 47, Part 15 B, (Digital device) / Part 15 C (Chapter 15.247)
Industry Canada RSS-210, Iss 8 / RSS-GEN, Issue 3

Lieu du test:
Test location:

SMEE CE-Mesures
38 VOIRON - France

FCC ID :
IC :

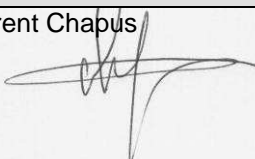
2AASDMZHP1
11314A-MZHP1

Test réalisé par :
Test realized by:

Jérémy BLANCHER

Conclusion :
Conclusion:

L'équipement satisfait aux prescriptions des normes citées en référence.
The appliance complies with requirements of above mentioned standards.

Ed.	Date	Modifications Pages	Written by: Visa	Approved by: Visa
1	October 24 th , 2013	Initial Edition	Jérémy Blancher	Laurent Chapus 

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SUMMARY

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1. Test program

• References

FCC CFR 47, PART 15, Subpart B and C

ANSI C63.4 (2009). American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

Chapter 15.247 of Subpart C (Operation within the band 2400-2483.5 MHz). Digitally modulated radiators.

FCC Guidance "Measurement of Digital Transmission Systems operating under Section 15.247".

Industry Canada RSS-GEN (Issue 3/2010) - General Requirements and Information for the Certification of Radio Apparatus

Industry Canada RSS-210 (Issue 8/2010) - Licence-exempt Radio Apparatus (All Frequency Bands). Category I Equipment.

• Test Results

TEST	Paragraph number (FCC Part 15.247) / IC RSS-210	Spec. (FCC Part 15.247) / IC RSS-210	RESULTS (comments)
Conducted emissions test	15.107 / 15.207 (a)	Table 15.207 (a)	PASS
Unintentional radiations	15.109 / 15.209 15.247 (d) / 15.205 RSS-Gen 4.10	Measure at 300m 9-490kHz: 2400µV/m/F(kHz) Measure at 30m 0.490-1.705: 24000µV/m/F(kHz) 1.705-30MHz: 30µV/m Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	PASS
Hopping channel separation	15.247 (a) (1) / RSS-210 A8.1 (b)	Minimum separation 25kHz or the two-third 20dB bandwidth whichever is greater	PASS
Number of hopping frequencies	15.247 (a) (1) (iii) / RSS-210 A8.1 (d)	Minimum 15 channels used	PASS
Time of occupancy	15.247 (a) (1) (iii) / RSS-210 A8.1 (d)	Maximum 400ms per channel within 31.6s	PASS
Maximum Peak Output Power	15.247 (b) (1) (4) / RSS-210 A8.4 (2)	0.125W max / 21dBm (Conducted) 0.5W max / 27dBm (EIRP)	PASS
Spurious RF conducted / Band edge compliance	15.247 (d) / RSS-210 A8.5	-20dBc in any 100kHz outside frequency band.	PASS
Receiver spurious emission	RSS-Gen 4.10		PASS

PASS: EUT complies with standard's requirement

FAIL: EUT does not comply with standard's requirement

NA: Not Applicable

NP: Test Not Performed



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- **General conclusion:**

Measures and tests performed on the sample of the product MZHP1, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart B and C.

Measures and tests performed on the sample of the product MZHP1, in configuration and description presented in this test report, show compliance with standards Industry Canada RSS-Gen and RSS-210.



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2. Equipment Under Test (EUT)

Nom /
Identification

**MUZIK Smart On Ear
(Wireless headphones) / MZHP1**

Sn: Sample #1
Sn: Sample #2
Sn: Sample #3

Auxiliaires /
Auxiliaries

Smart Cable (4 wires, 1.5m)
Motorola XT890 (Android smartphone)
USB charger PHIHONG PSM03A-050Q
(100-240V 50-60Hz // 5V dc / 500mA)

Entrées-Sorties /
Input / Output

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
DC input (5V/0.5A) Micro USB connector	USB2.0 / 0.5m	Yes	No
3.5mm INPUT JACK	Smart cable	No	No

Version programme /
Firmware version

N.C

Alimentation /
Power supply

3.7V from lithium-ion battery (Internal)

Mode de fonctionnement /
Running mode

The tested samples can be set in following modes:
- Bluetooth transmit mode to a smartphone (Normal operation, sample #1)
- Audio file listening on headphones with smart cable (Direct audio, sample #1)
- Battery charging with 5VDC power adapter (Normal operation, sample #1)
A special connection to sample #2 (radiated measurement) and sample #3 (conducted measurement) permits to set the EUT in following modes:
- Transmit on selectable channel (low, mid, high)
- Choice of modulation type, packet type, packet size
- Output Tx power set at its maximum value
(BlueTest 3 from CSR test program)

Information sur l'équipement /
Equipment information

- Frequency hopping from 2402 MHz to 2480 MHz
- Antenna type: PIFA on PCB (Peak gain < 1dBi), single antenna
- Modulations: GFSK (DH5)
π/4DQPSK (2-DH5)
8DPSK (3-DH5)
- Battery type Lithium-ion 3.7V-700mH
- Bluetooth module BTM720 with CSR BlueCore5
- Low channel: 2402MHz / Mid channel: 2441MHz / High channel: 2480MHz

3. Test conditions

Relative Humidity : 55%
Temperature : 21°C

Power supply voltage:

Equipment under test: 3V.7dc from battery (Fully charged)
110V/60Hz –AC mains for battering charging (Conducted emission)

4. Modifications of the equipment under test

No modification applied to the tested equipment during tests.



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5. Conducted Emission Measurement

TEST: Limits for conducted disturbance 150kHz – 30MHz (Clause 15.107 / 15.207)				Verdict
<u>Method:</u> The LISN is placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on lines were made at the output of the LISN. The LISN (measure) is 50Ω / 50μH. The EUT is 80cm above the ground reference plane and 40cm from the vertical ground plane. The AC power cable is 1m length.				Pass
Laboratory Parameters:		Required prior to the test		During the test
Ambient Temperature		10 to 40 °C		21°C
Relative Humidity		10 to 90 %		55%
Fully configured sample scanned over the following frequency range		Frequency range on each side of line		Measurement Point
		150kHz to 30MHz		AC input port (110V)
Running mode		Battery charging : Wireless transmission & Wired direct audio		
Limits for AC power port				
Frequency (MHz)	Limit dB (μV)			
	Quasi-Peak	Result	Average	Result
0.15 – 0.50	66 à 56	Pass	56 à 46	Pass
0.50 – 5	56	Pass	46	Pass
5 – 30	60	Pass	50	Pass
Supplementary information: Test location: SMEE – CE Mesures / Test date: September 6 th , 2013 Power supply voltage: 110V / 60Hz				

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator	SMEE	ATT#1	ATT-101-004	2013/3	2014/3
Cable RF	Div	2m / BNC	CAB-101-005	2013/3	2014/3
LISN (50Ω / 50μH)	AFJ	LS16C	RSI-101-001	2013/3	2014/3
LISN (50Ω / 50μH)	AFJ	LS16C	RSI-101-002	2013/3	2014/3
Reference comb gen.	SMEE	EMC-250K	REF-111-001	-	-
Measuring receiver	Rohde & Schwarz	ESL3	REC-101-001	2012/6	2014/6



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Tabulated Results for Mains Terminal Disturbance Voltage on AC port (Wireless mode)

FREQ	Meas. PK	Mes. QP	LIMIT QP	Margin QP	Mes. AV	LIMIT AV	Margin AV	Line
(MHz)	(dBμV)	(dBμV)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
9.330	42.3	27.8	60.0	-32.2	19.9	50.0	-30.1	L1
22.950	34.5	23.0	60.0	-37.0	16.7	50.0	-33.3	L1
0.166	46.7	39.6	65.2	-25.5	26.8	55.2	-28.4	Neutral
0.454	41.0	34.9	56.8	-21.9	26.8	46.8	-20.0	Neutral
9.354	42.6	35.9	60.0	-24.1	26.1	50.0	-23.9	Neutral
Frequency band investigated:		150kHz-30MHz						
RBW:		9kHz						
Voltage:		110V / 60Hz						
Limit:		15.207 a)						
Final measurement detector:		Quasi-Peak and Average						
Wide Measurement Uncertainty:		± 5dB (k=2)						

Tabulated Results for Mains Terminal Disturbance Voltage on AC port (Audio mode with smart cable)

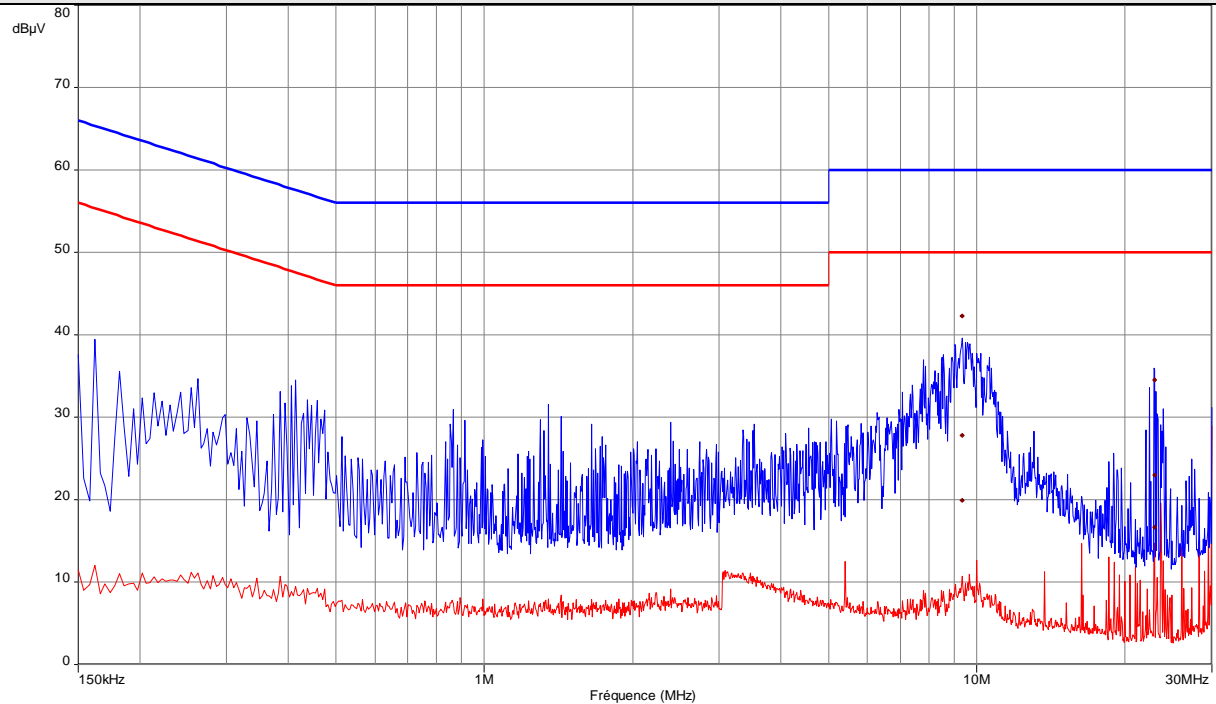
FREQ	Meas. PK	Mes. QP	LIMIT QP	Margin QP	Mes. AV	LIMIT AV	Margin AV	Line
(MHz)	(dBμV)	(dBμV)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
10.194	41.0	26.3	60.0	-33.7	7.6	50.0	-42.4	L1
16.342	27.0	23.9	60.0	-36.1	14.3	50.0	-35.7	L1
9.318	42.3	29.0	60.0	-31.0	8.2	50.0	-41.8	Neutral
19.278	28.5	17.7	60.0	-42.3	2.5	50.0	-47.5	Neutral
Frequency band investigated:		150kHz-30MHz						
RBW:		9kHz						
Voltage:		110V / 60Hz						
Limit:		15.207 a)						
Final measurement detector:		Quasi-Peak and Average						
Wide Measurement Uncertainty:		± 5dB (k=2)						



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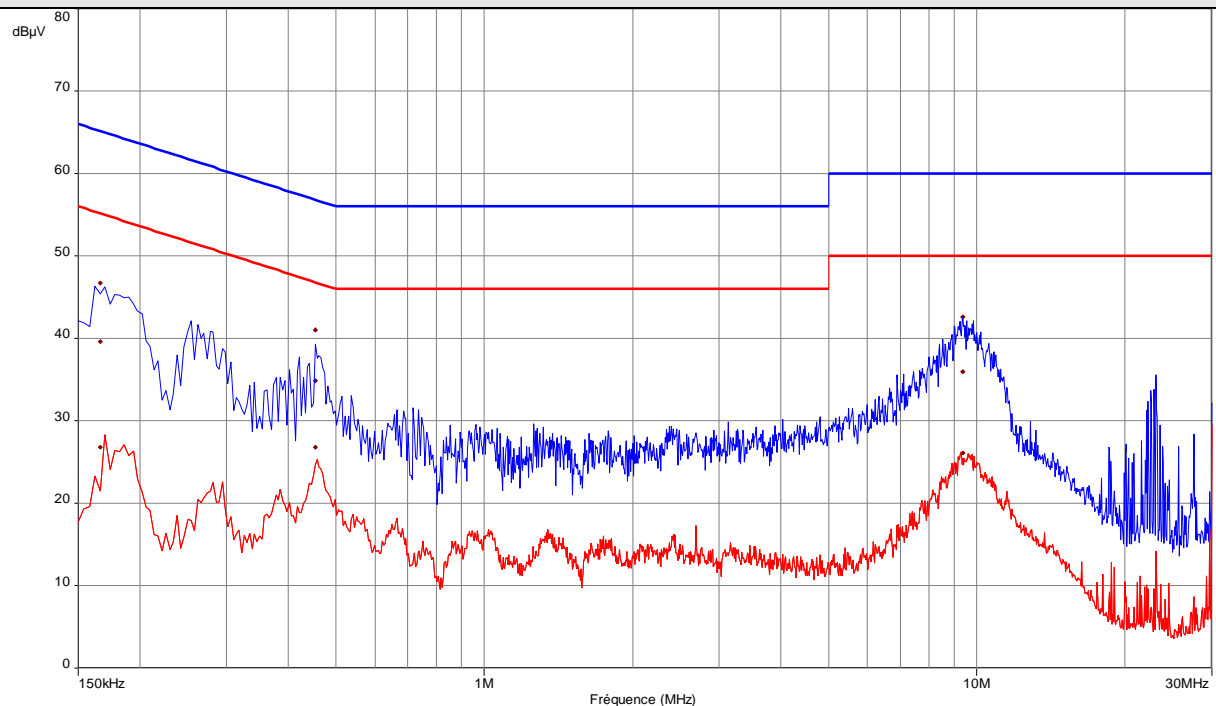
Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line L1 (Wireless mode)



-----: Peak

-----: Average

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Neutral (Wireless mode)



-----: Peak

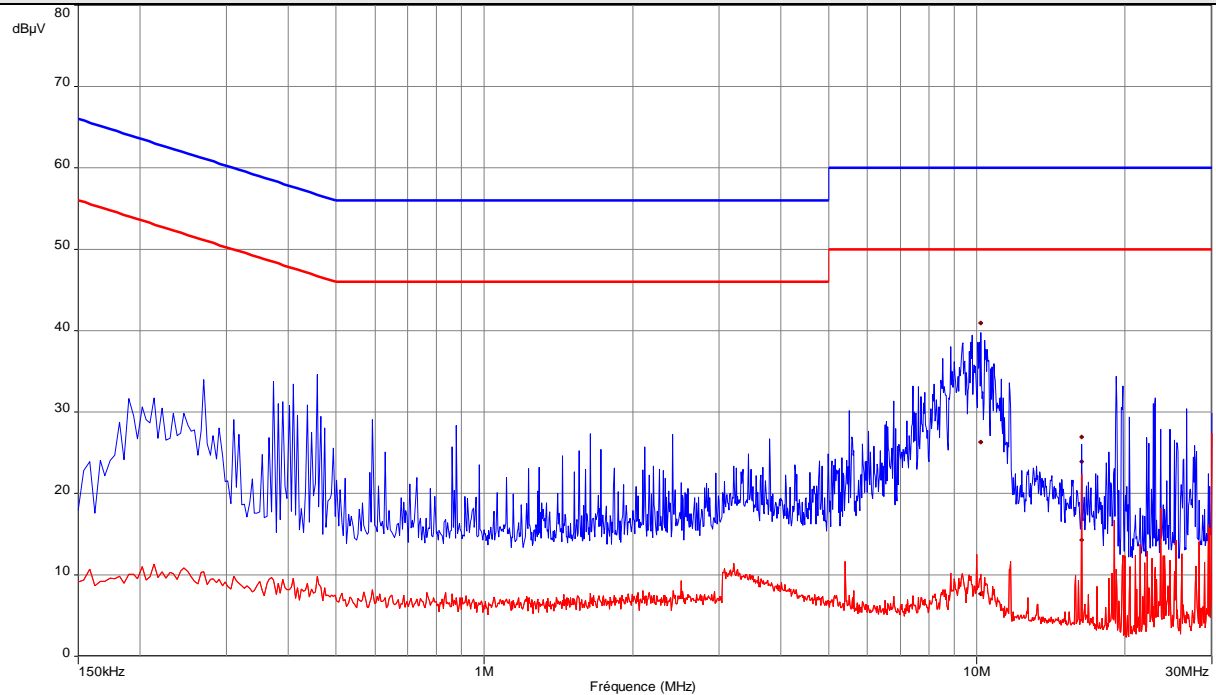
-----: Average



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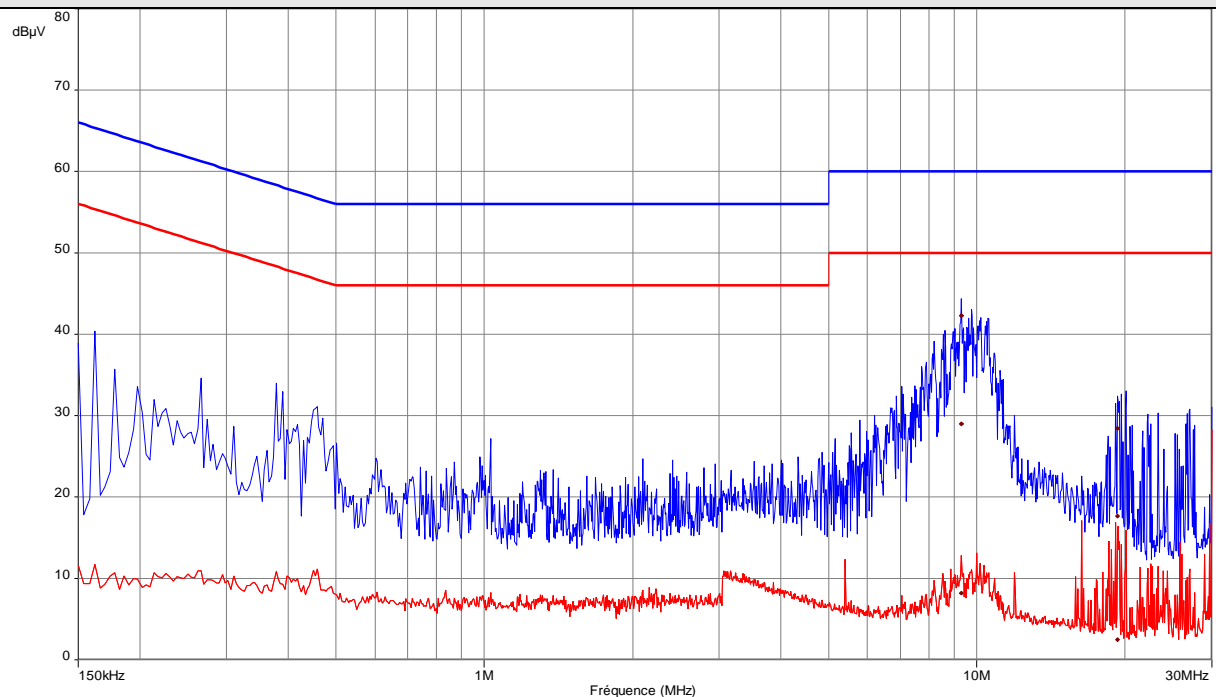
Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line L1 (Audio mode with smart cable)



----: Peak

----: Average

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Neutral (Audio mode with smart cable)



----: Peak

----: Average



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6. Radiated Emission Measurement (Unintentional Radiation)

TEST: Limits for radiated disturbance 9kHz – 25GHz (15.109 / 209)			Verdict
<p>Method: Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to CISPR 16. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.</p> <p>A pre-scan frequency identification of the EUT has been performed in a GTEM cell. The measured radiated field of the EUT is correlated to a measurement distance of 3m. (3-axis algorithm)</p> <p>The pre-characterization graphs are obtained in PEAK detection.</p>			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	21°C	
Relative Humidity	10 to 90 %	55%	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point	
	9kHz – 25GHz	3 m measurement distance	
Running mode	Wireless mode / Receive mode / Battery charging		
Limits – FCC Part 15.109 / 15.209			
Frequency (MHz)	Limit (dBµV/m)		
	Level / Detector	Distance (m)	Results
0.009 to 0.490	2400 (µV/m)/f (kHz) / QP	300	PASS
0.490 to 1.705	24000 (µV/m)/f (kHz) / QP	30	PASS
1.705 to 30	30 (µV/m) / QP	30	PASS
30 to 88	40.0 (dBµV/m) / QP	3	PASS
88 to 216	43.5 (dBµV/m) / QP	3	PASS
216 to 960	46.0 (dBµV/m) / QP	3	PASS
Above 960	54.0 (dBµV/m) / QP	3	PASS
Above 1GHz	54 (dBµV/m) / AV 74 (dBµV/m) / Pk	3	PASS
Supplementary information: Test location: SMEE – CE Mesures / Test date: September 5 th , 2013 Power supply voltage: 3.7V from battery			



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Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2013/5	2014/5
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2013/5	2014/5
Horn antenna	COM-POWER	AH-118	ANT-101-004	2012/8	2014/8
RF cable	Div	2m	CAB-101-011	2013/3	2014/3
RF cable	Div	OATS/25m	CAB-101-019	2013/3	2014/3
RF cable	Div	OATS/10m	CAB-101-020	2013/3	2014/3
RF cable	PASTERNAK RF	PE302-120	CAB-131-023	2013/9	2014/9
RF cable	PASTERNAK RF	PE302-120	CAB-131-024	2013/9	2014/9
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
OATS	Div	3 / 10m	SIT-101-001	2011/8	2012/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Measuring Rec	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
Spectrum Analyzer	HP / Agilent	8563E	ASP-111-003	2012/9	2014/9
Pre-amplifier	PE	PE1524	PRE-101-002	2013/3	2014/3

Tabulated Results for Radiated Disturbance (10m measurement on Open Area Test Site) 9kHz-30MHz									
Test Frequency (MHz)	Meter Reading dB(μV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Total Factor (dB)	Level dB(μV/m)	Limit dB(μV/m)	Margin (dB)
No frequency observed									
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.									
Frequency band investigated:		9kHz-30MHz							
RBW:		9kHz							
Measurement distance:		10m							
Limit:		15.209							
Final measurement detector:		Quasi-Peak							
Wide Measurement Uncertainty:		± 5.2dB (k=2)							



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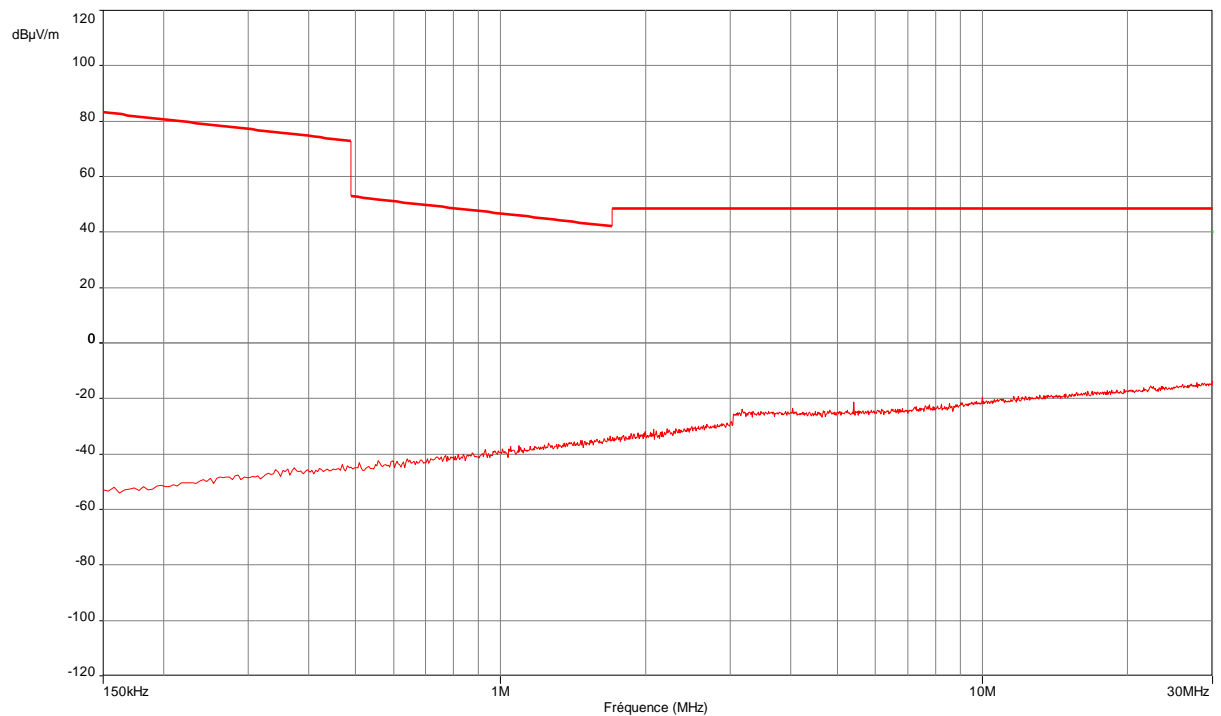
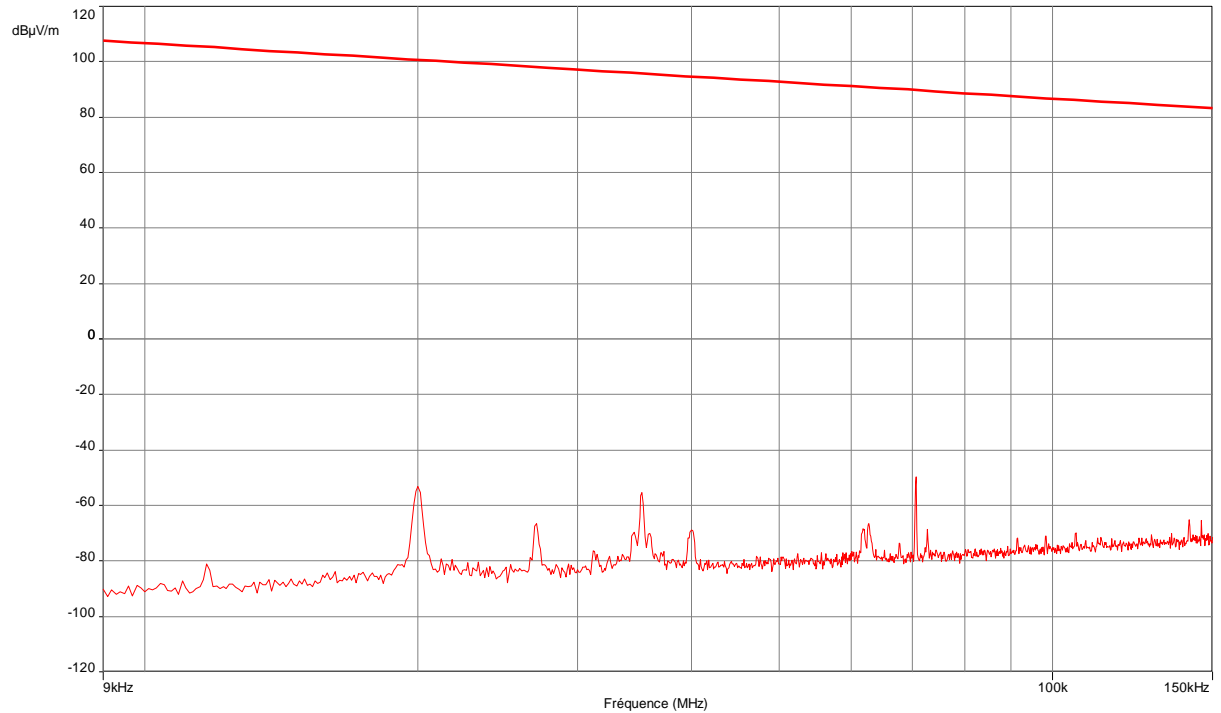
Tabulated Results for Radiated Disturbance (3m measurement on Open Area Test Site) 30MHz-1GHz									
Test Frequency (MHz)	Meter Reading dB(μV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Total Factor (dB)	Level dB(μV/m)	Limit dB(μV/m)	Margin (dB)
186.95	10.5	QP	V	75	100	18.6	29.1	43.5	-14.4
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results. Worst case results for receive mode or direct audio mode.									
Frequency band investigated:		30MHz-1GHz							
RBW:		120kHz							
Measurement distance:		3m							
Limit:		15.109 / 15.209							
Final measurement detector:		Quasi-Peak							
Wide Measurement Uncertainty:		± 5.2dB (k=2)							
Field Strength Calculation:		<p>The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:</p> $FS = RA + AF + CF - AG$ <p>Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain</p> <p>Total factor (dB) is $AF + CF - AG$ Margin value = Emission level – Limit value</p>							



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Graphical representation of Radiated Disturbance Measurement / 9kHz – 30MHz (Peak detection, GTEM pre-scan) – Transmit Mode (Worst case 1-DH5)



Note: Pre-scan graph only for identification purpose

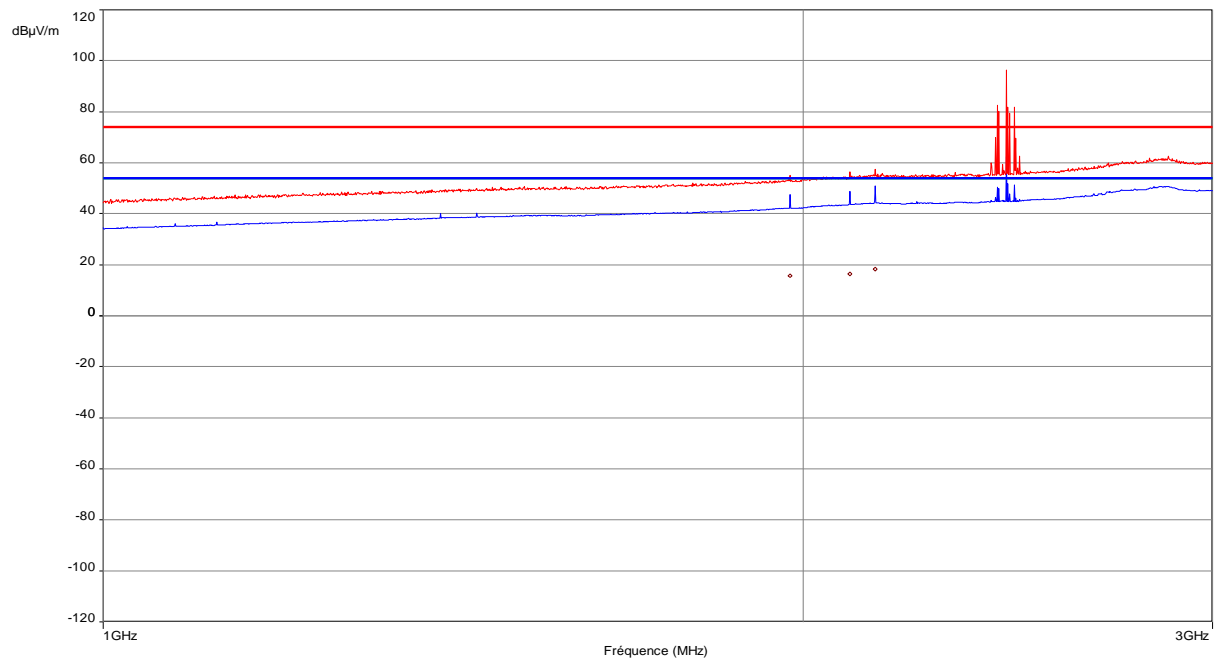
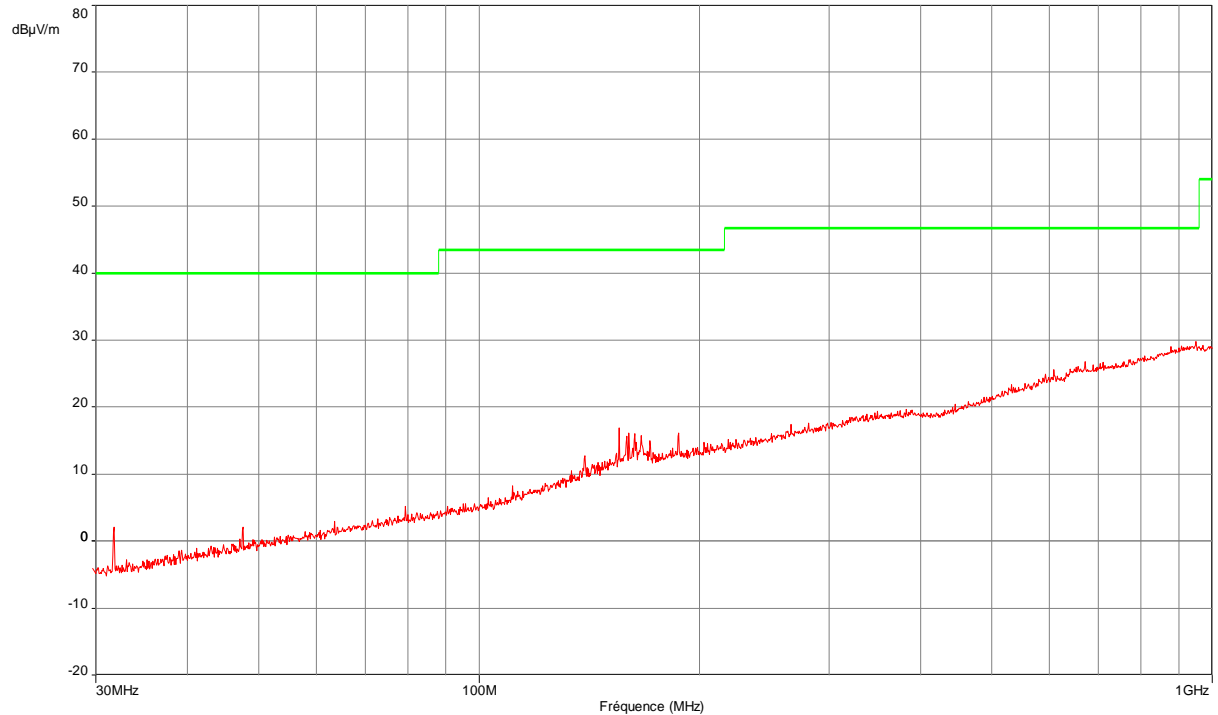
----- : Peak measure/limit



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Graphical representation of Radiated Disturbance Measurement / 30MHz – 3GHz (Peak detection, GTEM pre-scan) - Transmit Mode (Worst case 1-DH5)



Frequency (MHz)	Comment
1975.0	External noise
2095.1	External noise
2147.5	External noise
2441.0	Intentional radiation

Note: Pre-scan graph only for identification purpose

----- : Peak measure/limit

----- : Average measure/limit

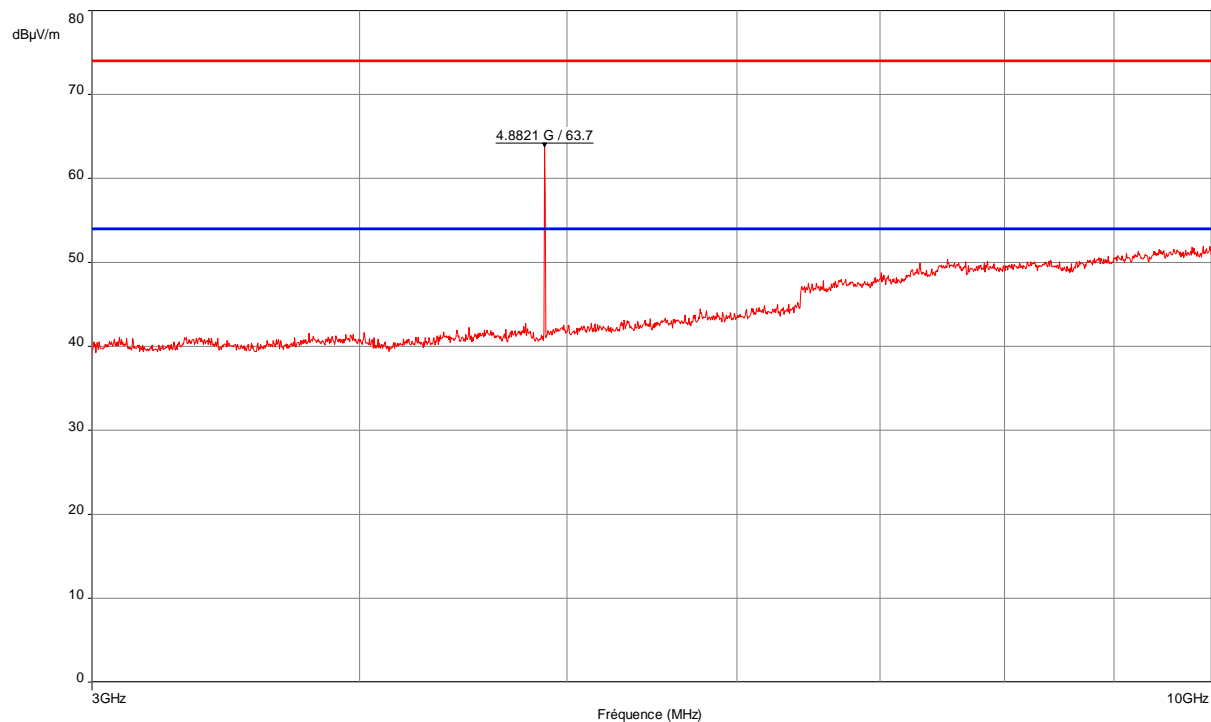
----- : Quasi-Peak limit



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Graphical representation of Radiated Disturbance Measurement / 3GHz – 10GHz (Peak detection, GTEM pre-scan) - Transmit Mode (Worst case 1-DH5)



Frequency (MHz)	Comment
4882.1	Spurious

Note: Pre-scan graph only for identification purpose

Note: No frequency observed above 10GHz

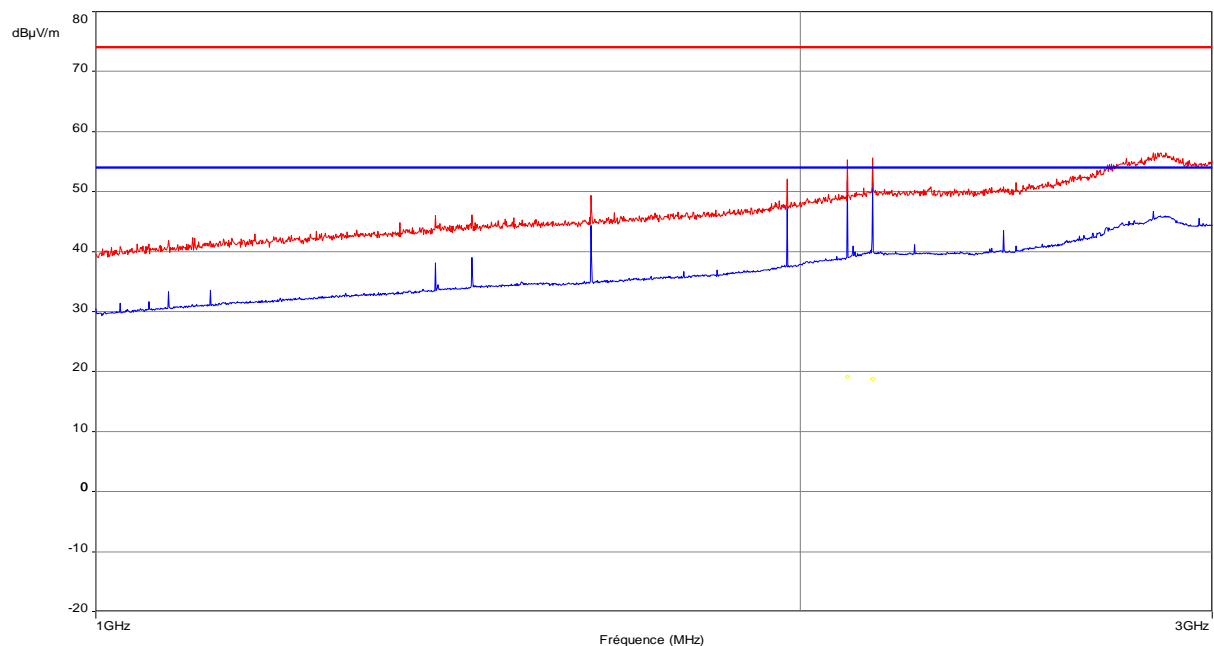
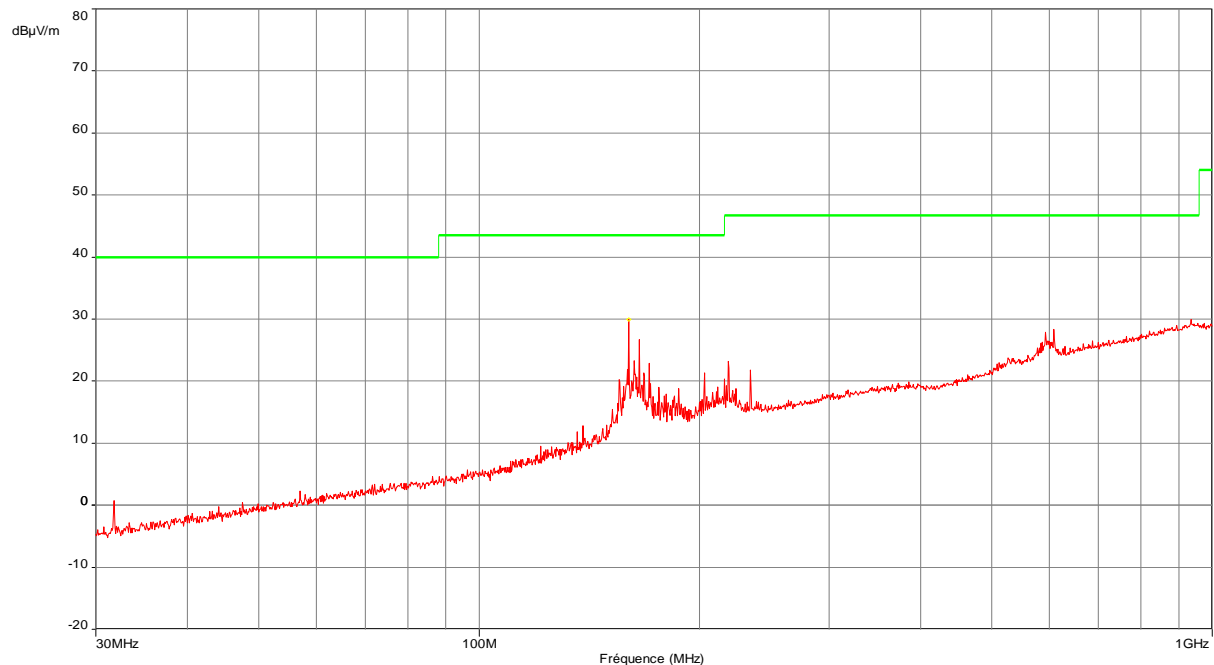
----- : Peak measure/limit ----- : Average limit



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Graphical representation of Radiated Disturbance Measurement / 30MHz – 3GHz (Peak detection, GTEM pre-scan) - Receive Mode



Frequency (MHz)	Comment
160.00	29.9 dBµV/m Peak
2095.1	External noise
2147.5	External noise

Note: Pre-scan graph only for identification purpose

Note: No frequency observed above 3GHz

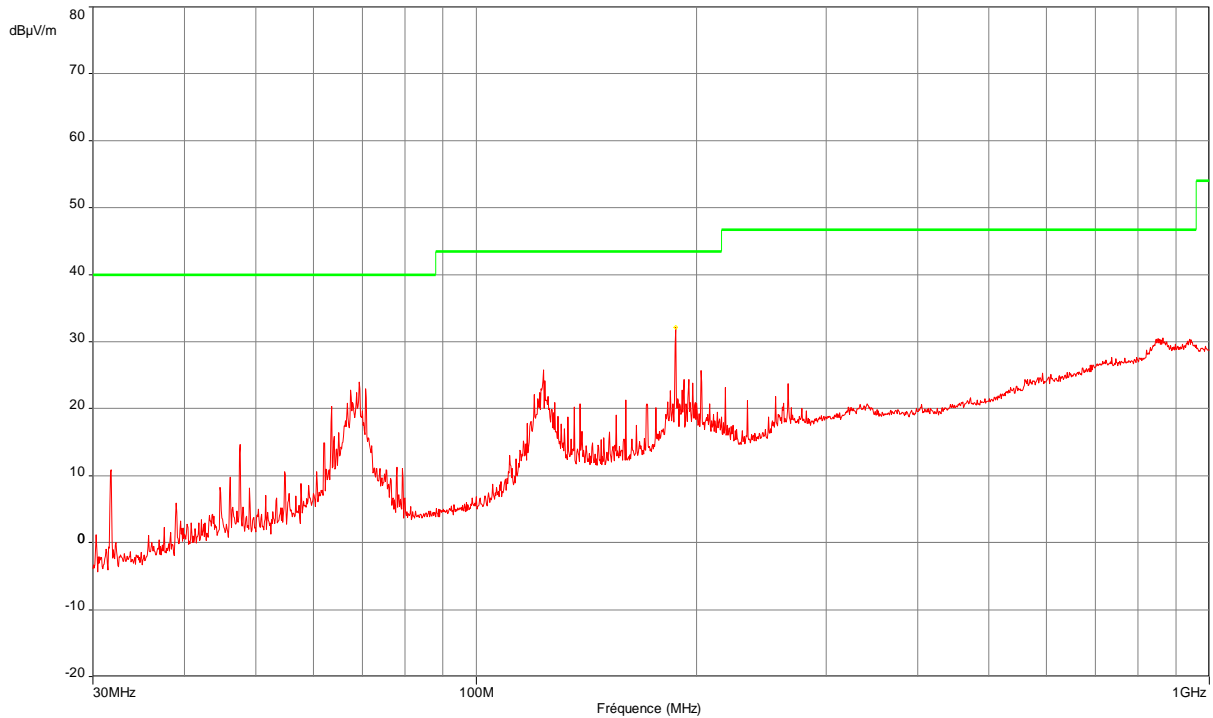
----- : Peak measure/limit ----- : Average measure/limit ----- : Quasi-Peak limit



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Graphical representation of Radiated Disturbance Measurement / 30MHz – 1GHz (Peak detection, GTEM pre-scan) – Audio mode with smart cable



Frequency (MHz)	Comment
186.95	32.2 dBμV/m Peak

Note: Pre-scan graph only for identification purpose

Note: No frequency observed above 1GHz

----- : Peak measure/limit ----- : Quasi-Peak limit



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7. Maximum Peak Conducted Output power

TEST: Maximum peak conducted output power (FCC part 15.247 (b) (1)/(4)) RSS-210 A8.4 (2)	Verdict
<p><u>Method:</u> Measurements were performed with peak detector using a 10MHz RBW. The VBW is set to 10MHz. The spectrum analyzer is connected via suitable means to the RF output of the tested equipment. (Conducted measurement). For field strength, the measure is performed on a 3m Open Area Test Site. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel.</p> <p><u>Limits:</u> 0.125W or 21dBm (conducted) / 27dBm with antenna gain.</p> <p>Supplementary information: Test location: SMEE – CE Mesures / Test date: September 4th, 2013 Power supply voltage: 3.7V from battery (fully charged)</p>	Pass

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
Horn antenna	COM-POWER	AH-118	ANT-101-004	2012/8	2014/8
RF cable	Div	OATS/10m	CAB-101-020	2013/3	2014/3
OATS	Div	3 / 10m	SIT-101-001	2013/5	2014/5
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-

Tabulated Results for Maximum peak output power (Conducted measurement)			
Modulation DH5 / GFSK			
FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	5.4	21.0	PASS
2441	6.2	21.0	PASS
2480	6.2	21.0	PASS
Modulation 2-DH5 / π /4DQPSK			
FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	2.7	21.0	PASS
2441	3.1	21.0	PASS
2480	2.9	21.0	PASS
Modulation 3-DH5 / 8DPSK			
FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	2.7	21.0	PASS
2441	3.1	21.0	PASS
2480	2.9	21.0	PASS



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Tabulated Results for Maximum peak output power (Radiated measurement)				
FREQ	Field Strength 3m	Calculated EIRP	Limit	Result
(MHz)	(dBμV/m)	(dBm)	(dBm)	
2402	99.9	4.7	27.0	PASS
2441	101.4	6.2	27.0	PASS
2480	100.7	5.5	27.0	PASS

Note 1: Radiated measurement is the worst case → Modulation DH5 / GFSK

Note 2: Field strength is measured on the Open Area Test Site at a distance of 3m. Three orthogonal axis measurement is performed for both horizontal and vertical antenna (measure) polarization in order to obtain the maximum peak field strength.

The power (EIRP) was calculated using the following equation:

$$\text{EIRP} = (\text{E} \times \text{d})^2 / 30$$

Where D is the distance in meters from which the field strength was measured

E is the maximum field strength in V/m



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8. Channel Separation

TEST: Hopping channel measurement (15.247 (a) (1)) / RSS-210 A8.1 (b)	Verdict
<p><u>Method:</u> The Equipment under test is connected to the measuring receiver with suitable mean. The SPAN is adapted to see the frequency band of operation. The spectrum analyzer RBW was 100kHz and VBW was 100kHz.</p> <p>The channel separation is measured with the hopping function enable on the EUT.</p> <p><u>Limits:</u> Minimum separation between channels shall be 25kHz or the two-third 20dB bandwidth, whichever is greater.</p>	Pass
<p>Supplementary information: Test location: SMEE – CE Mesures / Test date: September 5st, 2013 Power supply voltage: 3.7V from battery</p>	

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
RF cable	PASTERNAK RF	PE354-150	CAB-131-025	2013/9	2014/9

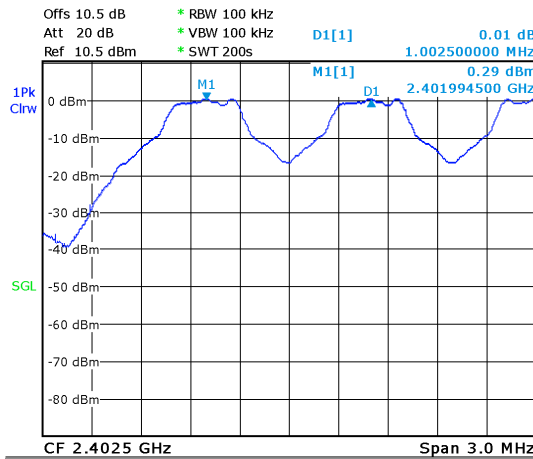
Tabulated Results for Hopping Channel Separation (Conducted measurement)				
Modulation DH5 / GFSK				
Channel frequency	Adjacent channel separation	20dB Bandwidth	Minimum limit	Result
(MHz)	(MHz)	(MHz)	(MHz)	
2402	1.003	1.102	0.735	PASS
2441	0.994	1.102	0.735	PASS
2480	1.006	1.102	0.735	PASS
Modulation 2-DH5 / $\pi/4$ DQPSK				
Channel frequency	Adjacent channel separation	20dB Bandwidth	Minimum limit	Result
(MHz)	(MHz)	(MHz)	(MHz)	
2402	1.006	1.365	0.910	PASS
2441	1.000	1.365	0.910	PASS
2480	1.006	1.359	0.906	PASS
Modulation 3-DH5 / 8DPSK				
Channel frequency	Adjacent channel separation	20dB Bandwidth	Minimum limit	Result
(MHz)	(MHz)	(MHz)	(MHz)	
2402	1.000	1.371	0.914	PASS
2441	1.000	1.371	0.914	PASS
2480	1.000	1.365	0.910	PASS



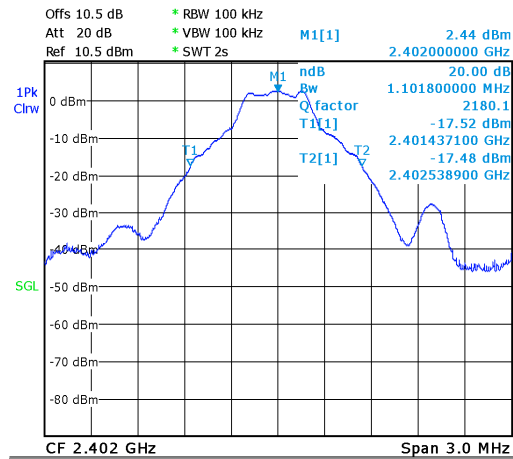
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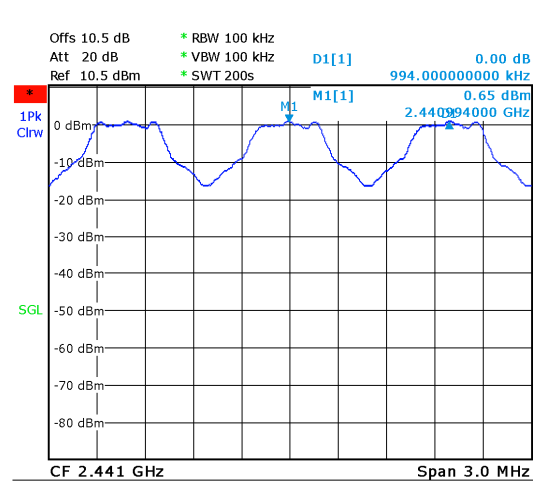
Graphical representation of Hopping channel separation (Modulation 1-DH5 / GFSK)



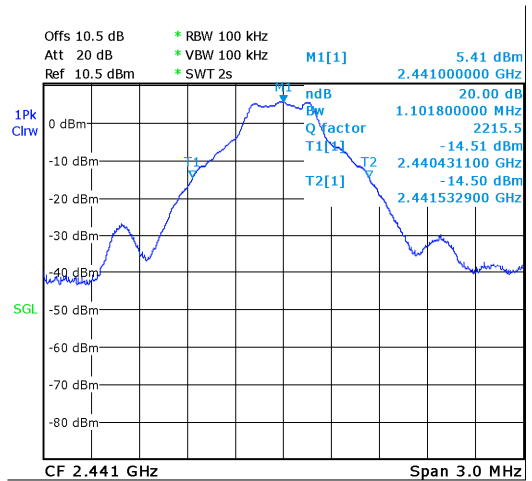
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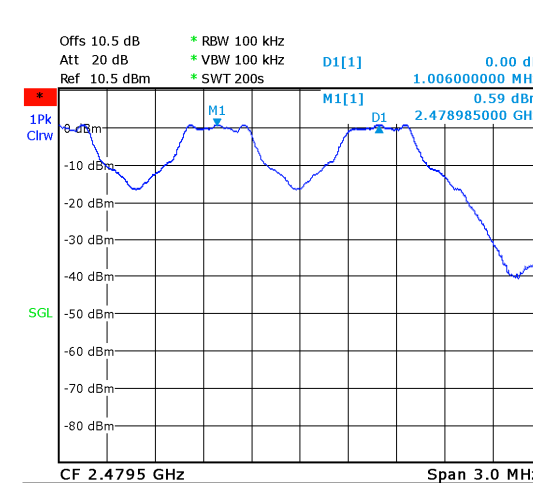
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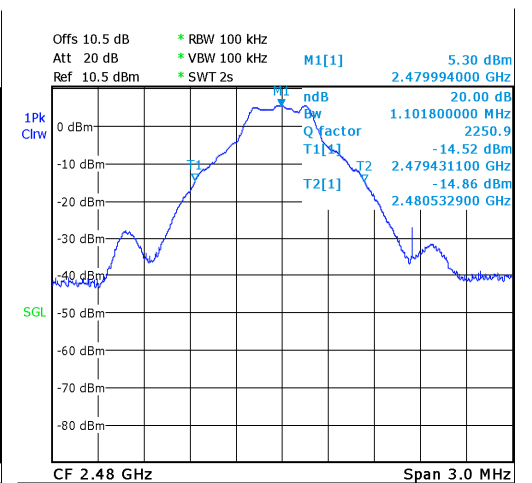
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Date: 5.SEP.2013 12:23:18



Date: 5.SEP.2013 11:55:04



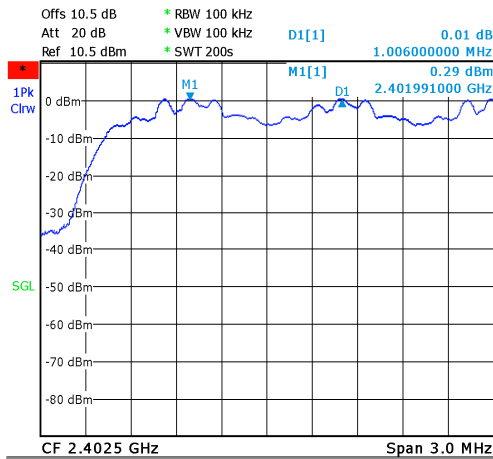
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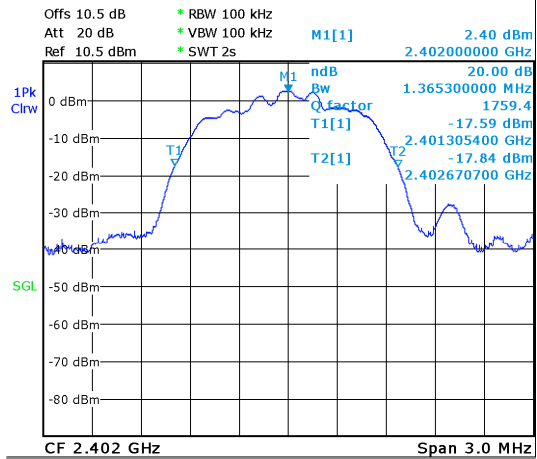
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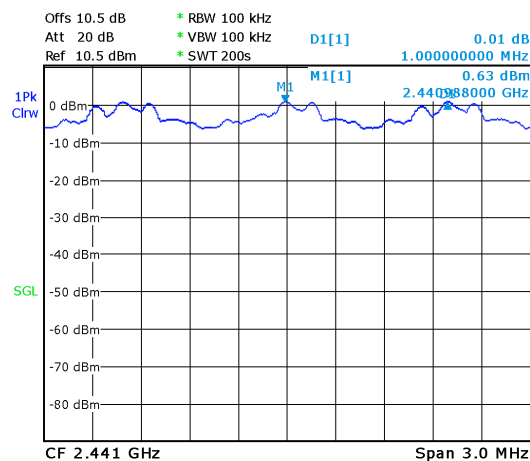
Graphical representation of Hopping channel separation (Modulation 2-DH5 / $\pi/4$ DQPSK)



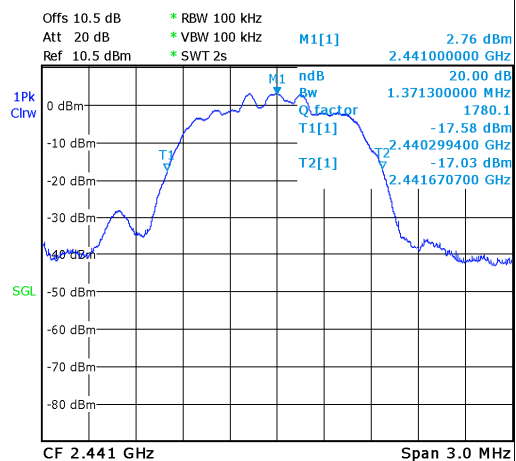
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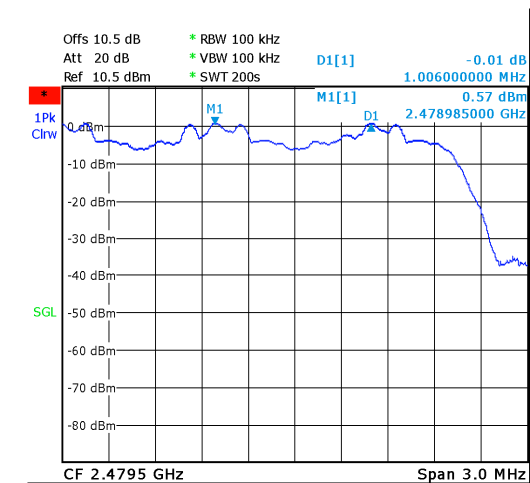
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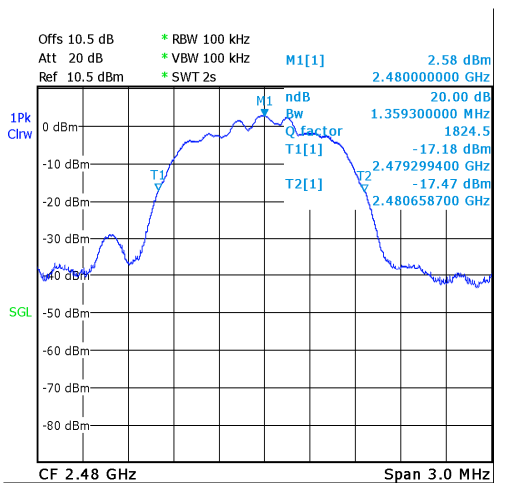
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Date: 5.SEP.2013 12:28:33



Date: 5.SEP.2013 11:40:45



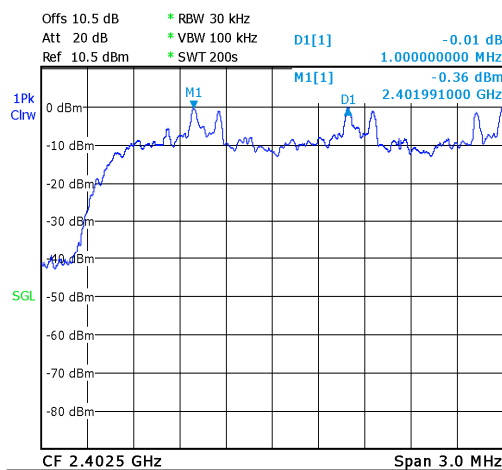
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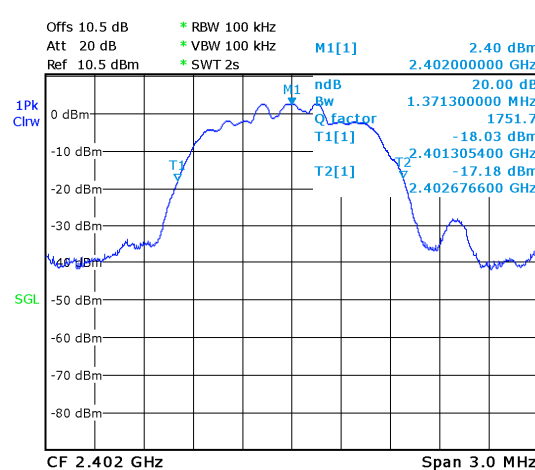
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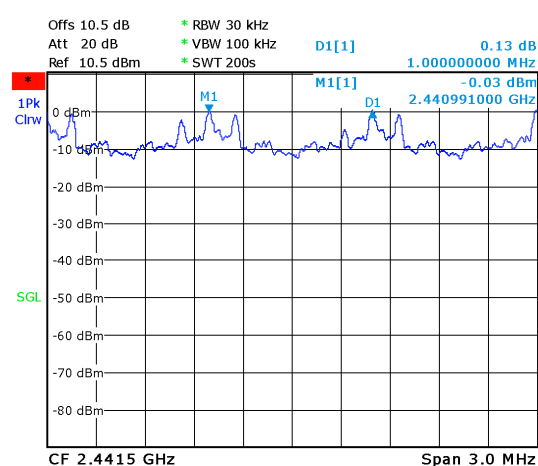
Graphical representation of Hopping channel separation (Modulation 3-DH5 / 8DPSK)



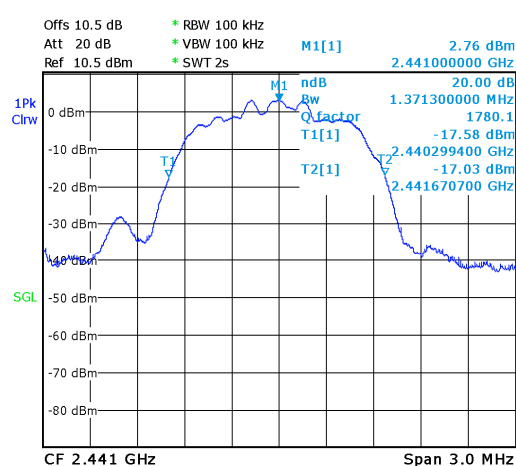
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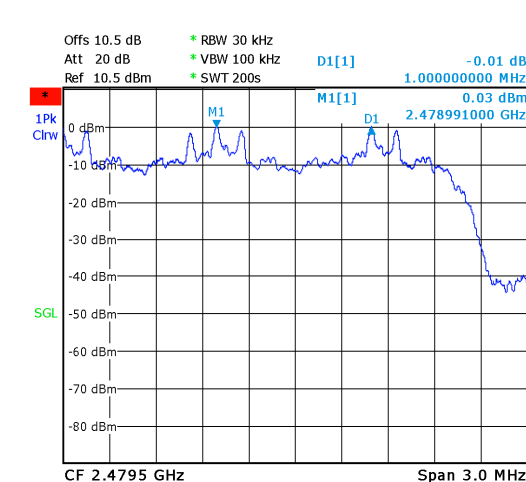
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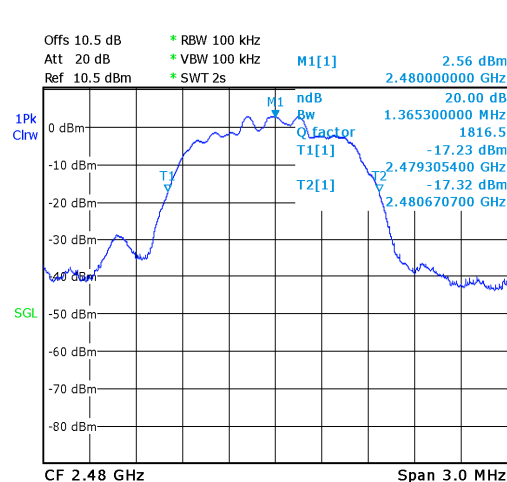
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Date: 5.SEP.2013 12:28:33



Date: 5.SEP.2013 11:35:47



Date: 5.SEP.2013 12:29:23



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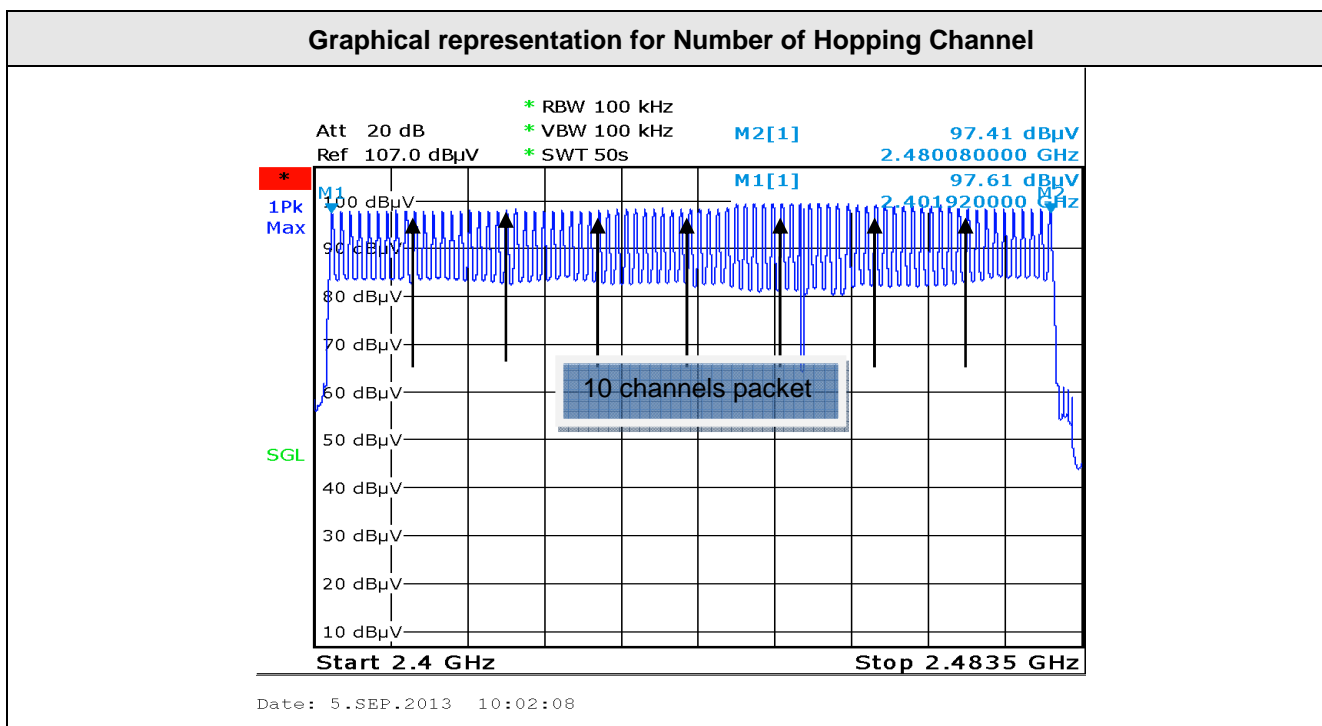
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9. Number of hopping channels

TEST: Number of hopping channels (15.247 (a))			Verdict
<p>Method: The Equipment under test is connected to the measuring receiver with suitable mean. The SPAN is adapted to see the frequency band of operation. The spectrum analyzer RBW was 100kHz and VBW was 100kHz.</p> <p>The EUT has its hopping function enable.</p> <p>Limits: At least 15 channels frequencies shall be used and equally spaced, in the band 2400-2483MHz.</p> <p>Supplementary information: Test location: SMEE – CE Mesures / Test date: September 5st, 2013 Power supply voltage: 3.7V from battery</p>			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	21°C	
Relative Humidity	10 to 90 %	55%	

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
RF cable	PASTERNAK RF	PE354-150	CAB-131-025	2013/9	2014/9

Tabulated Results for Number of Hopping Channel		
Number of channels	Minimum number of channels	Result
79	15	PASS





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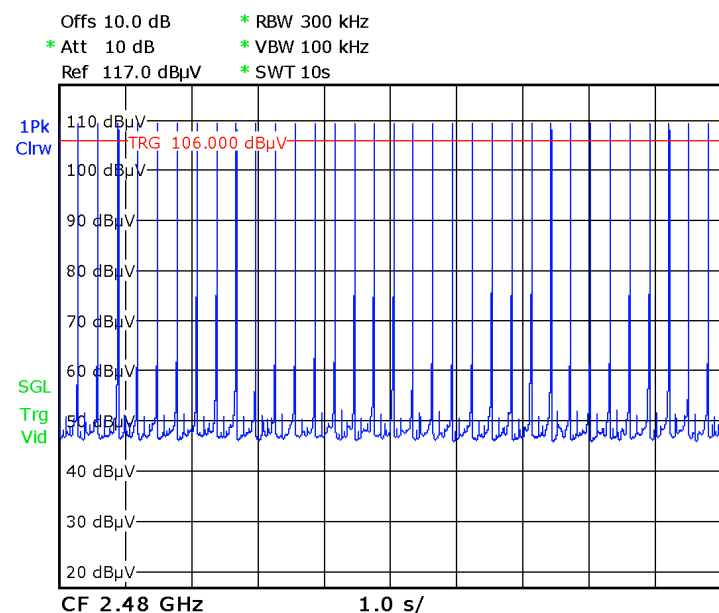
10. Time of occupancy (Dwell time)

TEST: Time of occupancy (15.247 (a) (1) (iii) / RSS-210 A8.1 (d))			Verdict
<u>Method:</u> The Equipment under test is connected to the measuring receiver with suitable mean. The spectrum analyser is set to zero-span. The EUT has its hopping function enable. <u>Limits:</u> 400ms of transmission by channel on a period 31.6s. (79 channels used)			Pass
Supplementary information: Test location: SMEE – CE Mesures / Test date: September 5 st , 2013 Power supply voltage: 3.7V from battery			
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	21°C	
Relative Humidity	10 to 90 %	55%	

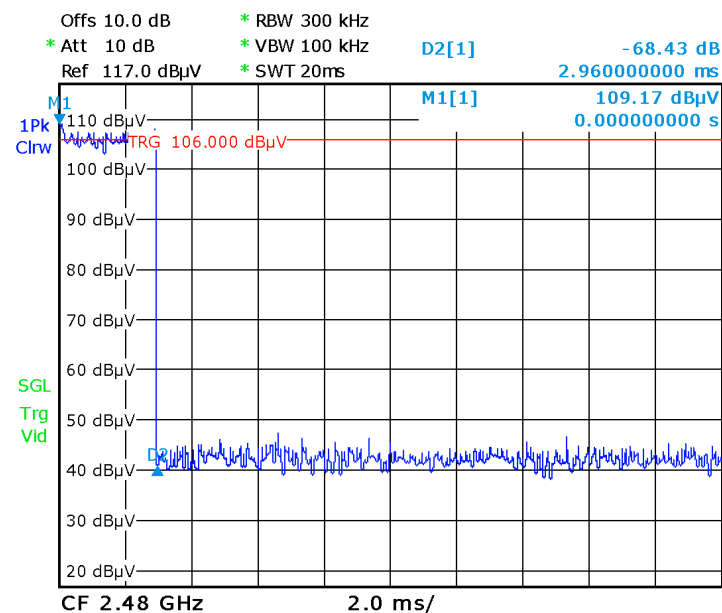
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
RF cable	PASTERNAK RF	PE354-150	CAB-131-025	2013/9	2014/9

Tabulated Results for Dwell time					
Number of pulses per 10s	Number of pulses per 31.6s period	Length of 1 pulse (ms)	Time of occupancy (ms)	Limit (ms)	Result
34	108	2.96ms	320ms	400ms	PASS
Additional information: Results for the worst case → Modulation 3-DH5 (8DPSK) Period of 31.6s (0.4s x 79 channels)					

Graphical representation for Dwell time (Modulation 8DPSK)



Date: 5.SEP.2013 15:49:47



Date: 5.SEP.2013 15:49:19



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11. Out-of-band emission / Band edge compliance

TEST: Spurious Emissions (15.247 (d)) / RSS-210 A8.5			Verdict
<p>Method: Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to CISPR 16 and ANSI C63.4 requirements. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. EUT is placed 80cm above the ground reference plane.</p> <p>A pre-scan frequency identification of the EUT has been performed in a GTEM cell. The measured radiated field of the EUT is correlated to the corresponding measurement distance.</p> <p>The algorithm used for calculation is 3 axes measurement.</p> <p>The pre-characterization graphs are obtained in PEAK detection.</p> <p>For conducted band-edge compliance, the Equipment under test is connected to the measuring receiver with suitable mean.</p>			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	21°C	
Relative Humidity	10 to 90 %	55%	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point	
	30MHz – 25GHz	3m distance	
Limits – Part 15C, clause 15.247 (d) / RSS-210 A8.5			
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radiofrequency 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. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).			
Supplementary information: Test location: SMEE – CE Mesures / Test date: September 9 st , 2013 Power supply voltage: 3.7V from battery			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2013/5	2014/5
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2013/5	2014/5
Horn antenna	COM-POWER	AH-118	ANT-101-004	2012/8	2014/8
RF cable	Div	2m	CAB-101-011	2013/3	2014/3
RF cable	Div	OATS/25m	CAB-101-019	2013/3	2014/3
RF cable	Div	OATS/10m	CAB-101-020	2013/3	2014/3
RF cable	PASTERNAK RF	PE302-120	CAB-131-023	2013/9	2014/9
RF cable	PASTERNAK RF	PE302-120	CAB-131-024	2013/9	2014/9
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
OATS	Div	3 / 10m	SIT-101-001	2011/8	2012/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Measuring Rec	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6



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Test Equipment Used

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	HP / Agilent	8563E	ASP-111-003	2012/9	2014/9
Pre-amplifier	PE	PE1524	PRE-101-002	2013/3	2014/3

Tabulated Results for Spurious Emissions – EUT emitting on low channel (2402MHz) (1-DH5 / GFSK)

No	Frequency (MHz)	Measured field (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Peak / Average	Comments
1	2402	99.2	-	-	PK	Fundamental (100kHz)
2	4804	62.1	74.0	-11.9	PK	Restricted band
3	4804	52.2	54.0	-1.8	AV	Restricted band

Tabulated Results for Spurious Emissions – EUT emitting on mid channel (2441MHz) (1-DH5 / GFSK)

No	Frequency (MHz)	Measured field (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Peak / Average	Comments
1	2441	100.7	-	-	PK	Fundamental (100kHz)
2	4882	61.8	74.0	-12.2	PK	Restricted band
3	4876	51.9	54.0	-2.1	AV	Restricted band

Tabulated Results for Spurious Emissions – EUT emitting on high channel (2480MHz) (1-DH5 / GFSK)

No	Frequency (MHz)	Measured field (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Peak / Average	Comments
1	2480	100.0	-	-	PK	Fundamental (100kHz)
2	4956	57.8	74.0	-16.2	PK	Restricted band
3	4956	47.9	54.0	-6.1	AV	Restricted band

Note 1: Peak measurement with 100 kHz RBW and VBW when frequency outside restricted bands.

Peak measurement with 1MHz RBW and VBW when frequency in restricted bands.

Average measurement with 1MHz RBW and 10Hz VBW when frequency in restricted bands

Note 2: All other frequencies are not traceable (20dB below limits)

Note 3: Worst case measurement for three orthogonal axis of EUT, with or without DC/audio cables.

Note 5: Worts case results for modulation type 1-DH5, 2-DH5 and 3-DH5

Note 4: The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

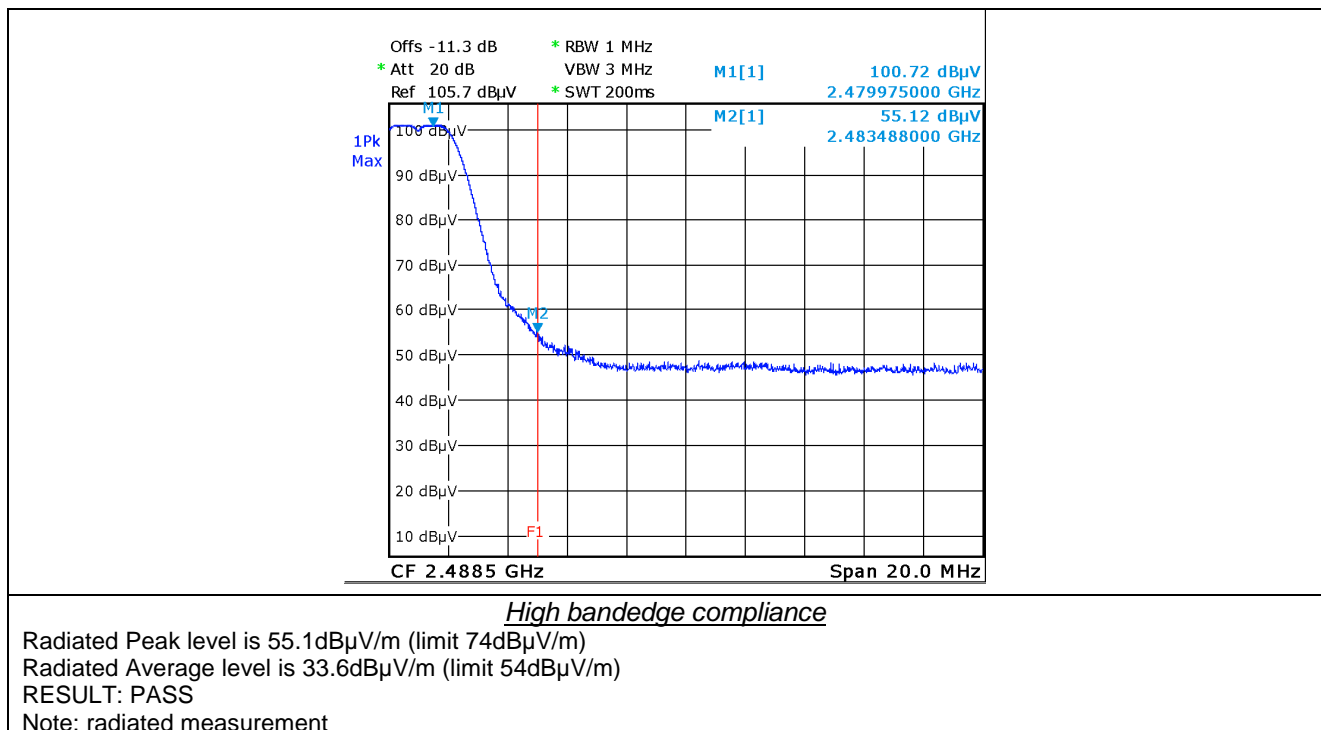
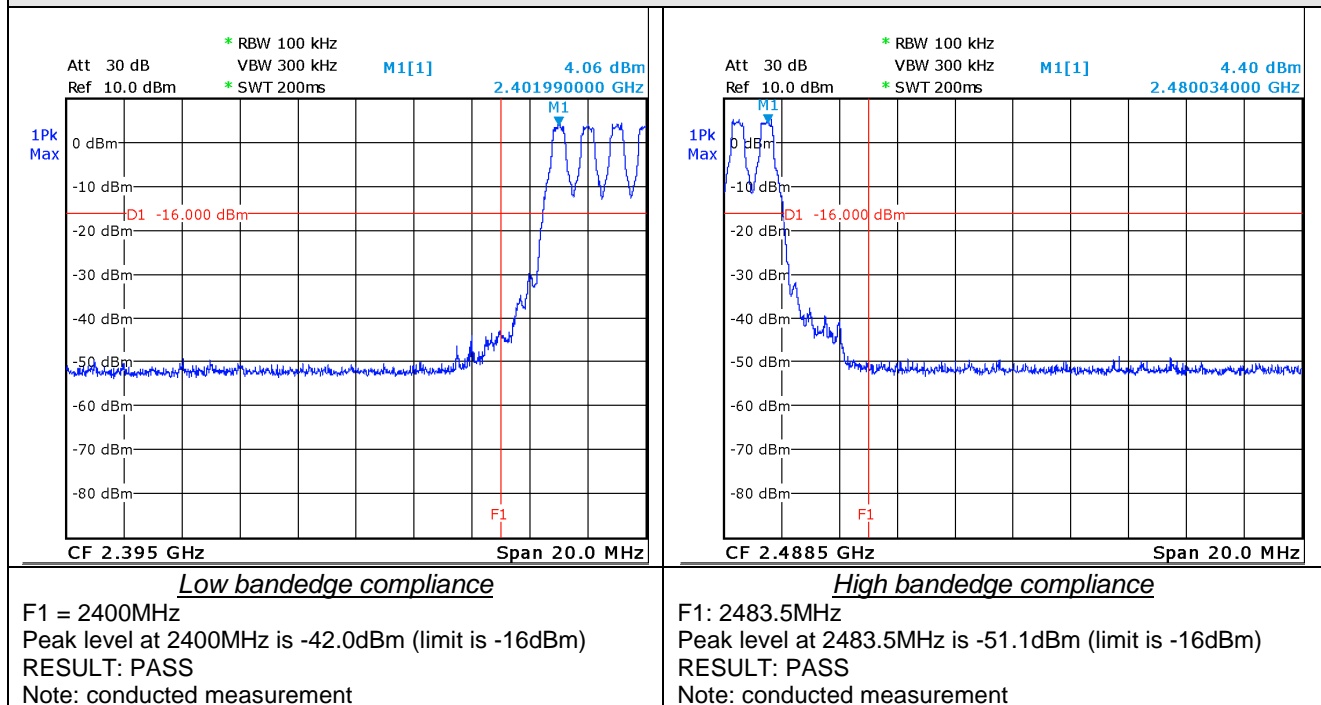
CF = Cable Factor

AG = Amplifier Gain

Total factor (dB) is AF + CF – AG

Margin value = Emission level – Limit value

Graphical representation of Band-edge compliance (Modulation 1-DH5 / GFSK)

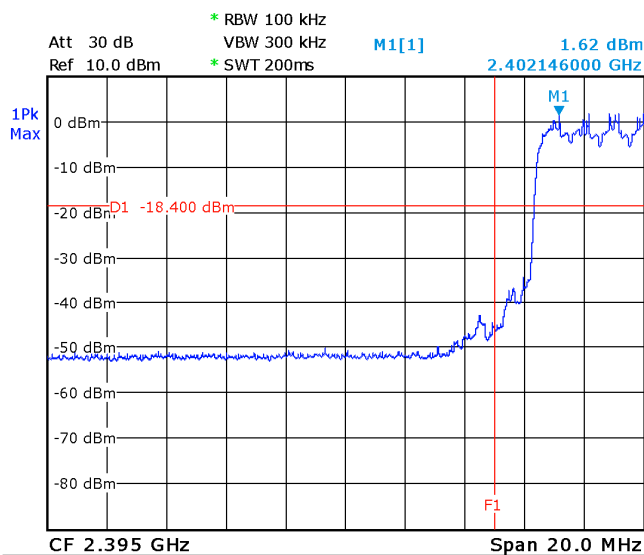




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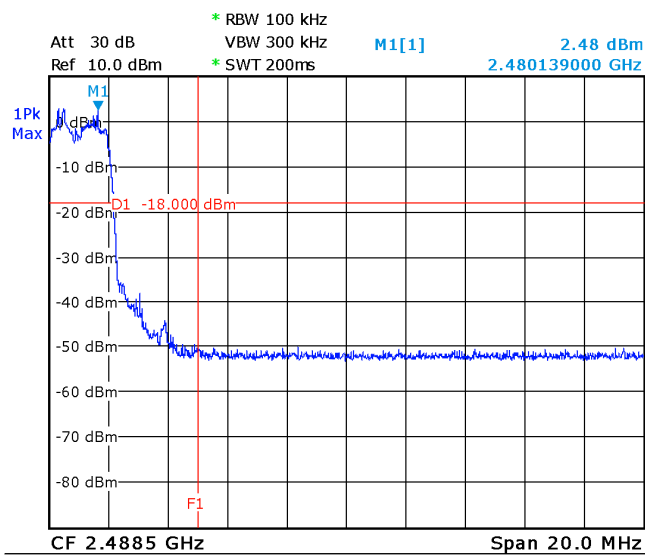
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Graphical representation of Band-edge compliance (Modulation 3-DH5 / 8DPSK)



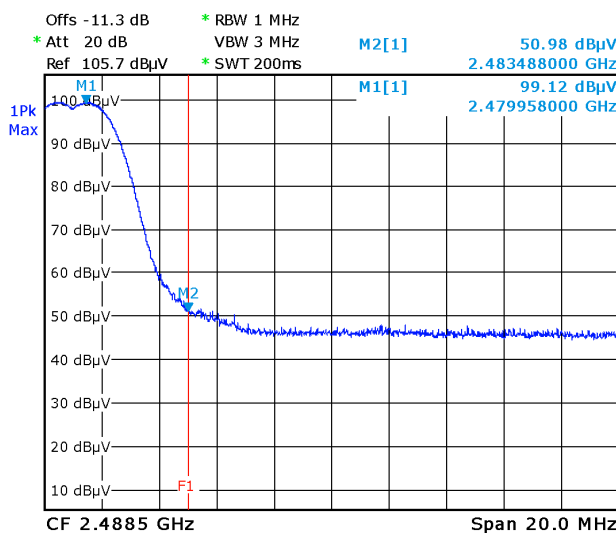
Low bandedge compliance

F1 = 2400MHz
Peak level at 2400MHz is -45.4dBm (limit is -18.4dBm)
RESULT: PASS
Note: conducted measurement



High bandedge compliance

F1: 2483.5MHz
Peak level at 2483.5MHz is -51.0dBm (limit is -18.4dBm)
RESULT: PASS
Note: conducted measurement



High bandedge compliance

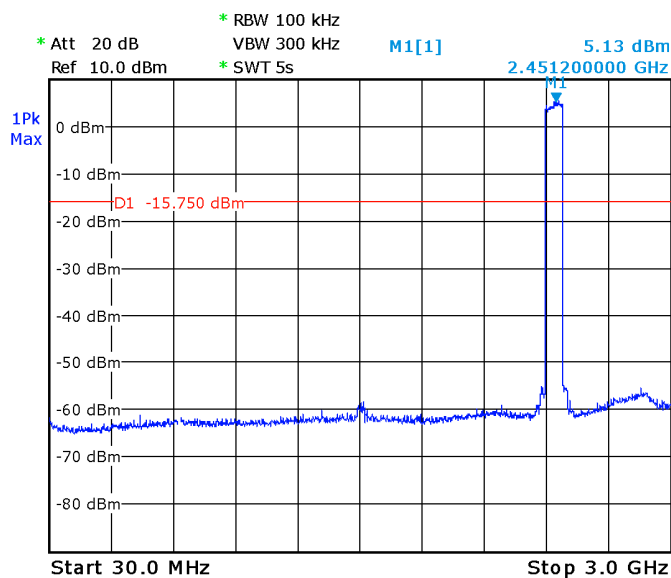
Radiated Peak level is 51.0dBμV/m (limit 74dBμV/m)
Radiated Average level is 33.1dBμV/m (limit 54dBμV/m)
RESULT: PASS
Note: radiated measurement



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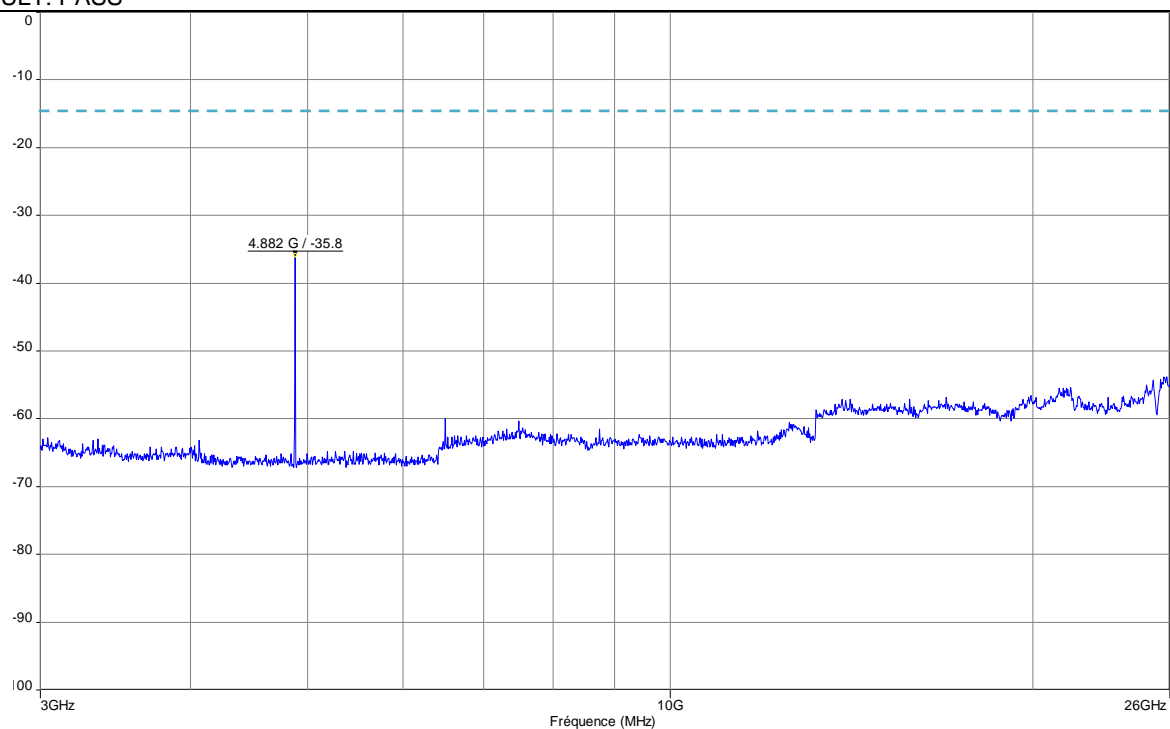
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Graphical representation of Band-edge compliance (Worst case Modulation 1-DH5 / GFSK)



Low bandedge compliance

Frequency 30MHz to 3GHz
RESULT: PASS



High bandedge compliance

Frequency 3GHz to 26GHz
Marker 4.882GHz / -35.8dBm (Limit is -15dBm)
RESULT: PASS



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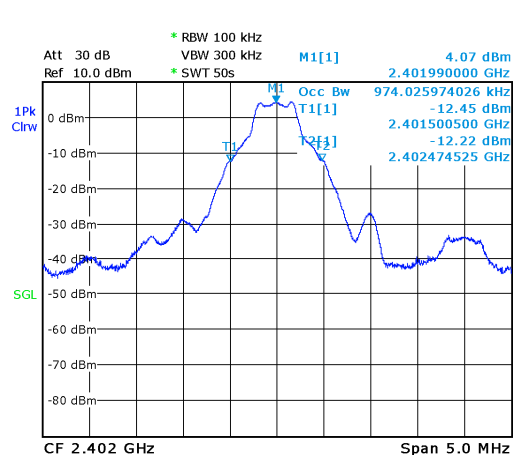
12. Occupied bandwidth (99%)

TEST: Occupied bandwidth (99%) / RSS-GEN	Verdict
<p><u>Method:</u> The Equipment under test is connected to the measuring receiver with suitable mean. The SPAN is adapted to see the frequency band of operation. The spectrum analyzer RBW was 100kHz and VBW was 100kHz.</p> <p>A special function on the spectrum analyser is used to measure the 99% OBW.</p>	Pass
<p>Supplementary information: Test location: SMEE – CE Mesures / Test date: September 6st, 2013 Power supply voltage: 3.7V from battery</p>	

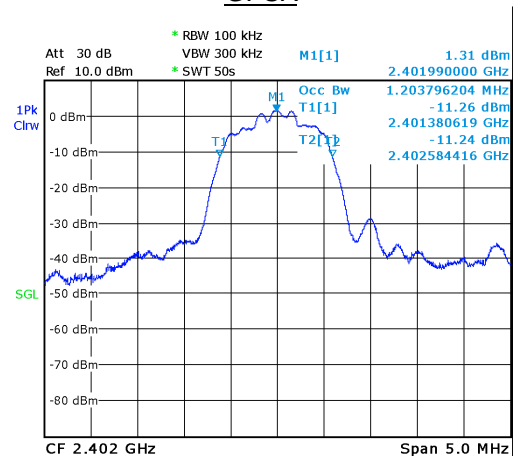
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
RF cable	PASTERNAK RF	PE354-150	CAB-131-025	2013/9	2014/9

Tabulated Results for Occupied Bandwidth	
Modulation type	99% Occupied Bandwidth
	(MHz)
GFSK	0.974026
$\pi/4$ DQPSK	1.203796
8DPSK	1.213786

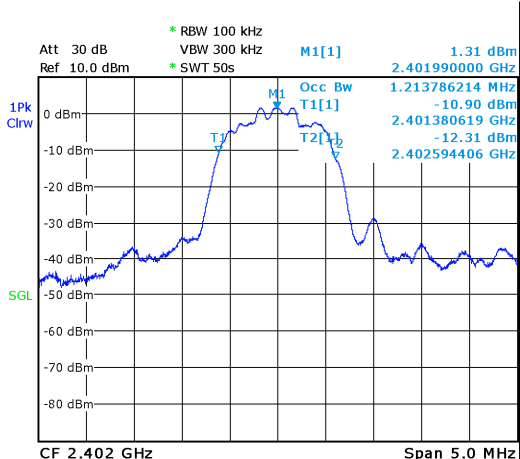
Graphical representation of Occupied Bandwidth



GFSK



$\pi/4$ QPSK



8DPSK