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September 22, 2015

Prüfbericht / *Test Report* Nr. / *No.* 20820838-50305-02 (Edition 4)

„Transmit Simultaneously“

Applicant:	Bartec GmbH
Type of equipment:	MC92N0ex IS RFID-LF INTERNAL (V2)
Type designation:	Mobile Reader with Bartec LF-Reader
Order No.:	100-6381640
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207 and 15.209 Industry Canada Radio Standards Specifications RSS-GEN Issue 4, Sections 8.8, 8.9 and 8.10 (Category I Equipment)

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Information pursuant to Section 2(1)
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TÜV SÜD Product Service GmbH

Äußere Frühlingstraße 45
94315 Straubing
Germany

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of Mobile Computer:	
Type designation[1]:	Mobile Computer
Type of equipment:	MC92N0
Manufacturer:	Motorola Solutions, Inc.
FCC ID:	TBUMC92N0EX
Comment:	Including WLAN 2.4GHz & 5 GHz & BT (see details below)

Data of the RFID Part:	
Type designation[2]:	MC92N0ex RFID-LF INTERNAL (V2)
Type of equipment:	Mobile Reader with Bartec LF-Reader
Manufacturer:	Bartec GmbH
Serial number(s):	1415600501134
Version:	As delivered
FCC ID:	TBULFG3
Industry Canada ID:	5736C-LFG3

[1] Type designation of the system if EUT consists of more than one part.
[2] Type designation of the system if EUT consists of more than one part.

Power supply of the EUT	
Type of power supply:	Battery supply
Specifications for battery supply:	nominal voltage: 7.4 V V minimum voltage: 7.0 V maximum voltage: 8.4 V nominal frequency: DC
Brand:	SYMBOL
Part No.:	82-111734-01
Specifications for power adapter:	nominal voltage: 115 V V minimum voltage: -- V maximum voltage: -- V nominal frequency: AC 50/60Hz
Brand:	HIPRO
P/N:	PWRS-14000-148R
S/N:	F33351144023415

Technical data of EUT	
Power Supply	DC 7.4 V from battery, DC 12 V to cradle or DC 12 V to connection adapter
Modulation Type	For RFID: AM For WLAN: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM For Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	For RFID: ASK For WLAN: DSSS, OFDM For Bluetooth: FHSS
Transfer Rate	For WLAN: 802.11b: up to11Mbps 802.11g / a: up to 54Mbps 802.11n (20MHz, 800ns GI): up to 65Mbps 802.11n (20MHz, 400ns GI): up to 72.2Mbps For BT Up to 3Mbps

Frequency Range	For RFID: 125 kHz, 134.2 kHz For WLAN(15.407) 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.5~5.58GHz & 5.66~5.7GHz For WLAN(15.247) 2.4GHz: 2.412 ~ 2.472GHz 5GHz: 5.745 ~ 5.825GHz For BT 2402MHz ~ 2480MHz
Number of Channels	For RFID: 2 For WLAN(15.407) 16 for 802.11a, 802.11n (20MHz) For WLAN(15.247, 2.4GHz) 13 for 802.11b, 802.11g, 802.11n (20MHz) For WLAN(15.247, 5GHz) 5 for 802.11a, 802.11n (20MHz) For BT 79
Channel Spacing	WLAN: 802.11b/g: 5 MHz 802.11a: 20 MHz Bluetooth: 1 MHz
Maximum Output Power	For RFID: < 8.1µW For WLAN(15.407) 802.11a: 66.069mW 802.11n (20MHz): 58.884mW For WLAN(15.247, 2.4GHz) 802.11b: 204.174mW 802.11g: 204.174mW 802.11n (20MHz): 208.930mW For WLAN(15.247, 5GHz) 802.11a: 169.824mW 802.11n (20MHz): 165.959mW For BT 2.891 mW

2 Administrative Data

Application details	
Applicant (full address):	Bartec GmbH Max-Eyth-Strasse 16 DE-97980 Bad Mergentheim
Contact person:	Ralph Lanig
Order number:	100-6381640
Receipt of EUT:	November 17, 2014
Date(s) of test:	November 17 to 24, 2014
Note(s):	--

Report details	
Report number:	20820838-50305-02
Edition:	4
Issue date:	September 22, 2015

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	TÜV SÜD Product Service GmbH
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
FCC test site registration number	90926
Industry Canada test site registration:	3050A-2
Contact person:	Mr. Johann Roidt Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

4 Summary

Summary of test results
The tested sample complies with the requirements set forth in the **Code of Federal Regulations CFR 47, Part 15, Subpart C, Subpart E** of the Federal Communication Commission (FCC) and the **Radio Standards Specifications** **RSS-GEN Issue 4** **RSS-210 Issue 8** of Industry Canada (IC).

Personnel involved in this report	
Laboratory Manager:	 Mr. Johann Roidt
Responsible for testing:	 Mr. Markus Biberger
Responsible for test report:	Mr. Markus Biberger

5 Operation Mode and Configuration of EUT

Operation Mode(s)
For this report the EUT was tested under WLAN and Bluetooth transmit simultaneously plus the RFID reader continuously reading a transponder. For WLAN function both the 5 GHz and 2.4 GHz bands were considered.

List of ports and cables				
Port	*Description*	*Classification*[3]	*Cable type*	*Cable length*
1	DC Power input (via battery)	dc power	Unshielded	--

List of devices connected to EUT				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	Transponder 125 kHz	Unique	N/A	--
2	Transponder 134.2 kHz	HDX	N/A	--

List of support devices				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	Cradle Dock			
2	AC Adapter			
3	Nokia 6150i	4	N/A	Apple
4	Wireless DSL Router	N600	N/A	Sitecom

[3] Ports shall be classified as ac power, dc power or signal/control port

List of test modes				
No	*Description*	*RFID Reader Frequency* [1]	*Bluetooth channels*	*WLAN Channel* [2]
1	RFID Reader continuously reading a Tag WLAN 15.247 (2.4 GHz)	125 kHz	deactivated	15.247 2.44 GHz
2	RFID Reader continuously reading a Tag WLAN 15.247 (5.18 GHz)	125 kHz	deactivated	15.407 5.18 GHz
3	RFID Reader continuously reading a Tag WLAN 15.247 (2.4 GHz)	132 kHz	deactivated	15.247 2.44 GHz
4	RFID Reader continuously reading a Tag WLAN 15.247 (5.18 GHz)	132 kHz	deactivated	15.407 5.18 GHz
5	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone	125 kHz	0 -78	deactivated
6	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone	132 kHz	0 -78	deactivated
7	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone WLAN 15.247 (2.4 GHz)	125 kHz	0 -78	15.247 2.44 GHz
8	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone WLAN 15.247 (5.18 GHz)	125 kHz	0 -78	15.407 5.18 GHz
9	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone WLAN 15.247 (2.4 GHz)	132 kHz	0 -78	15.247 2.44 GHz
10	RFID Reader continuously reading a Tag Bluetooth active, audio stream from mobile phone WLAN 15.247 (5.18 GHz)	132 kHz	0 -78	15.407 5.18 GHz

(1) If the Mobile Computer in the charging cradle, then the RFID transmitting unit switched off automatically by the operating system. Therefore conducted emission measurement was not conducted. Only one WLAN operating mode 2.4GHz or 5.18GHz is possible

(2) It´s only one WLAN operating mode possible, 2.4GHz or WLAN 5.18GHz

6 Measurement Procedures

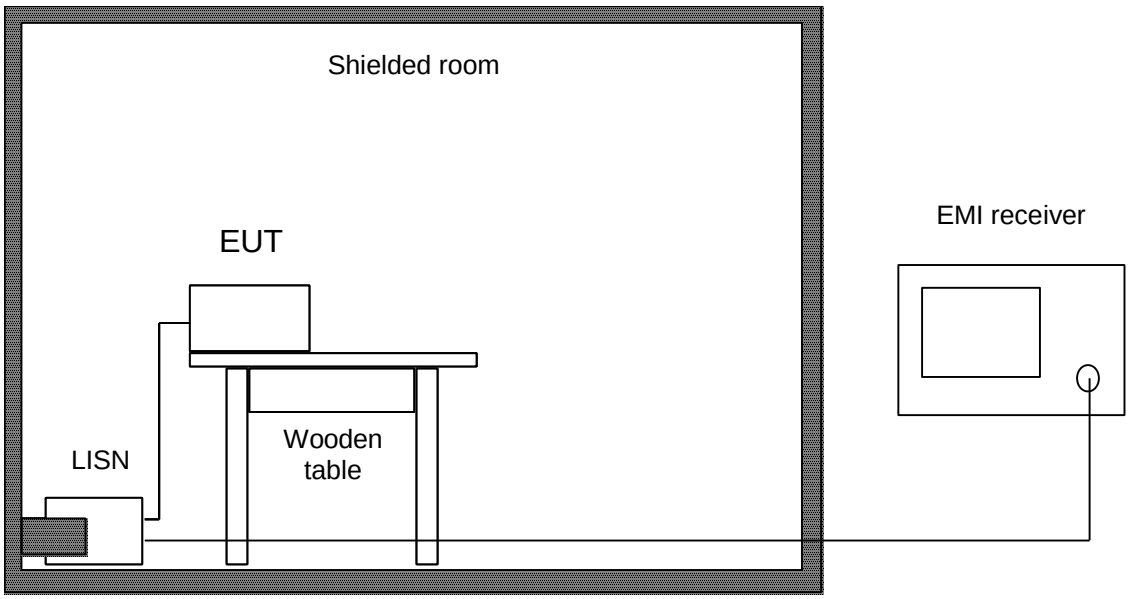
6.1 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-GEN Issue 4, section 8.8
Guide:	ANSI C63.4 / CISPR 22

Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak.
If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.

According to ANSI C63.4, section 13.1.3.1, testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.
Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☒	V-network	ESH 3-Z5	1060	862770/021	Rohde & Schwarz
☐	V-network	ESH 3-Z5	1218	830952/025	Rohde & Schwarz
☐	Artificial mains network	ESH 2-Z5	1536	842966/004	Rohde & Schwarz
☐	Shielded room	No. 1	1451	---	Albatross
☒	Shielded room	No. 4	1454	3FD 100 544	Euroshield

6.2 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.209 IC RSS-GEN Issue 4, sections 8.9 and 8.10
Guide:	ANSI C63.4

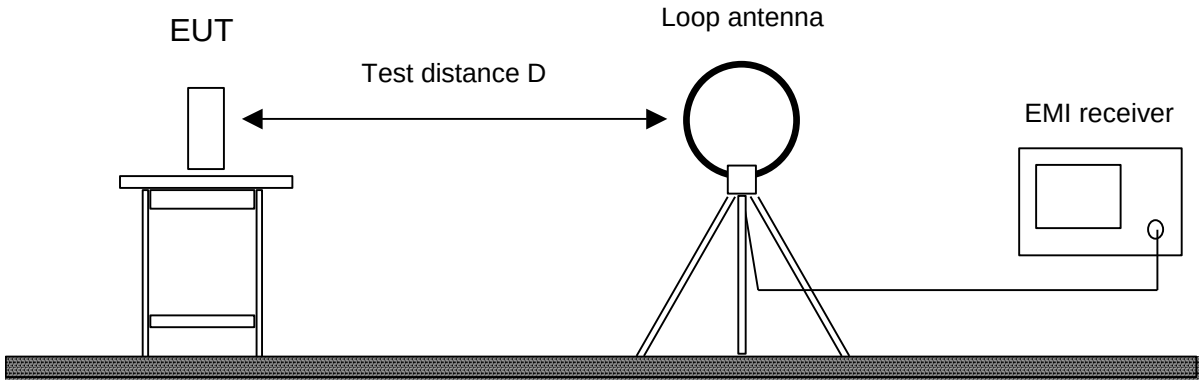
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.



Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Spectrum analyzer		FSP30	1666	100036	Rohde & Schwarz
☒	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☐	EMI test receiver		ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Test receiver		ESHS 10	1028	860043/016	Rohde & Schwarz
☐	Preamplifier	Cabin no. 2	CPA9231A	1716	3557	Schaffner
☒	Loop antenna		HFH2-Z2	1016	882964/1	Rohde & Schwarz
☐	Fully anechoic room		No. 2	1452	---	Albatross
☐	Semi anechoic room		No. 3	1453	---	Siemens
☐	Semi anechoic room		No. 8	2057	---	Albatross

6.3 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.209 IC RSS-GEN Issue 4, section 8.9
Guide:	ANSI C63.4

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

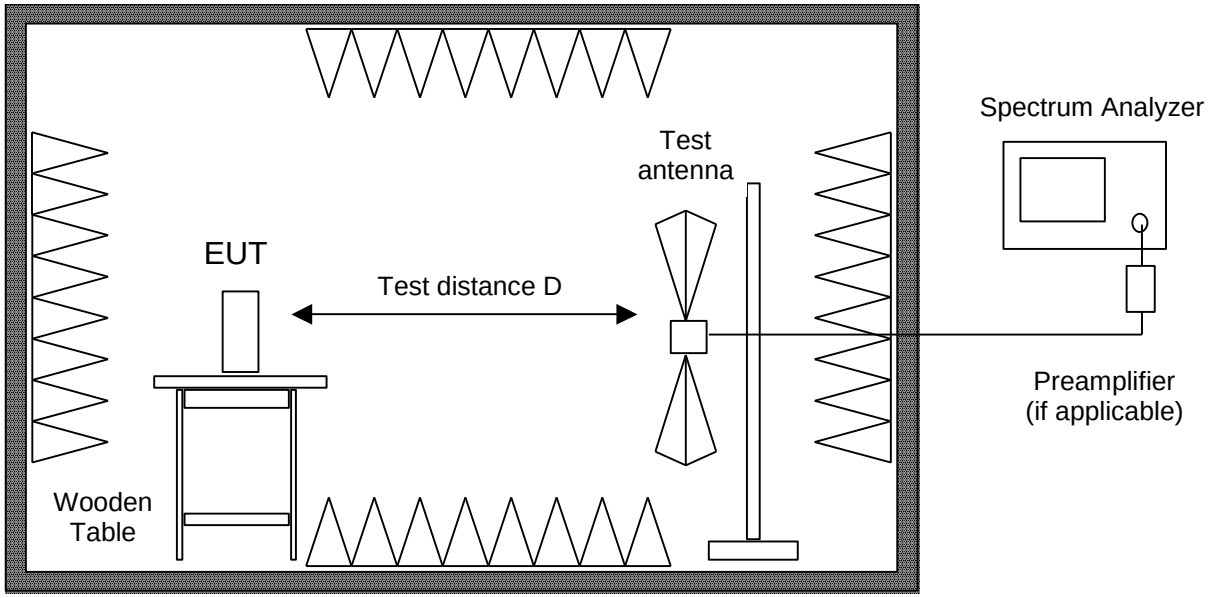
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 for alternative test sites is used (see 6.4). If prescans are recorded in fully anechoic room they are indicated appropriately.



Fully or semi anechoic room

Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Spectrum analyzer		FSP30	1666	100036	Rohde & Schwarz
☒	Spectrum analyzer		FSV40	2364	101448	Rohde & Schwarz
☐	EMI test receiver	Cabin no. 3	ESPI7	2010	101018	Rohde & Schwarz
☐	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☐	EMI test receiver		ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☒	Preamplifier	Cabin no. 2	CPA9231A	1716	3557	Schaffner
☐	Preamplifier		R14601	1142	13120026	Advantest
☒	Preamplifier (1 - 8 GHz)		AFS3-00100800-32-LN	1684	847743	Miteq
☐	Preamplifier (0.5 - 8 GHz)		AMF-4D-005080-25-13P	1685	860149	Miteq

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Preamplifier (8 - 18 GHz)		ACO/180-3530	1484	32641	CTT
☐	External Mixer		WM782A	1576	845881/005	Tektronix
☐	Harmonic Mixer Accessories		FS-Z30	1577	624413/003	Rohde & Schwarz
☐	Trilog antenna	Cabin no. 2	VULB 9163	1802	9163-214	Schwarzbeck
☐	Trilog antenna	Cabin no. 3	VULB 9163	1722	9163-188	Schwarzbeck
☒	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Horn antenna		3115	1516	9508-4553	EMCO
☐	Horn antenna		3160-03	1010	9112-1003	EMCO
☐	Horn antenna		3160-04	1011	9112-1001	EMCO
☐	Horn antenna		3160-05	1012	9112-1001	EMCO
☒	Horn antenna		3160-06	1013	9112-1001	EMCO
☒	Horn antenna		3160-07	1014	9112-1008	EMCO
☒	Horn antenna		3160-08	1015	9112-1002	EMCO
☒	Horn antenna		3160-09	1265	9403-1025	EMCO
☐	Horn antenna		3160-10	1575	399185	EMCO
☒	Horn antenna		WM782A	1576	845881/005	Tektronix
☒	Fully anechoic room		No. 2	1452	---	Albatross
☐	Semi anechoic room		No. 3	1453	---	Siemens
☐	Semi anechoic room		No. 8	2057	---	Albatross

6.4 Radiated Emission at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.209 IC RSS-GEN Issue 4, section 8.9
Guide:	ANSI C63.4

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

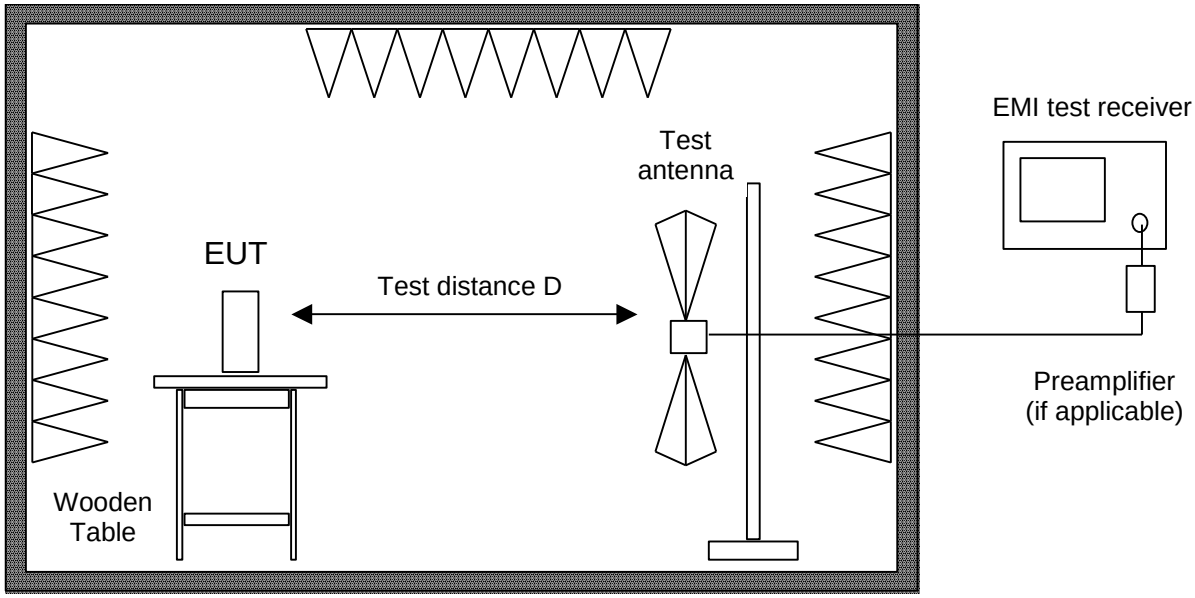
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is discharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Alternate test site (semi anechoic room)

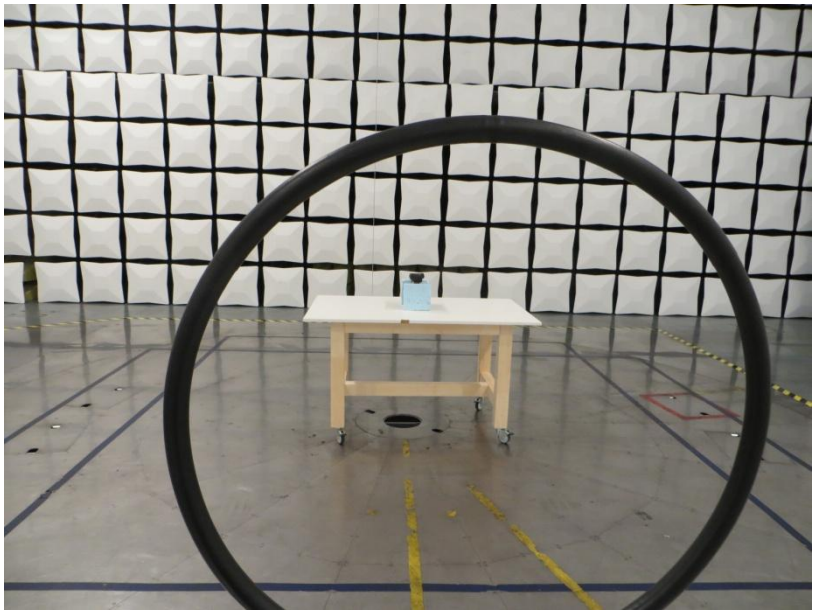
Test instruments used:

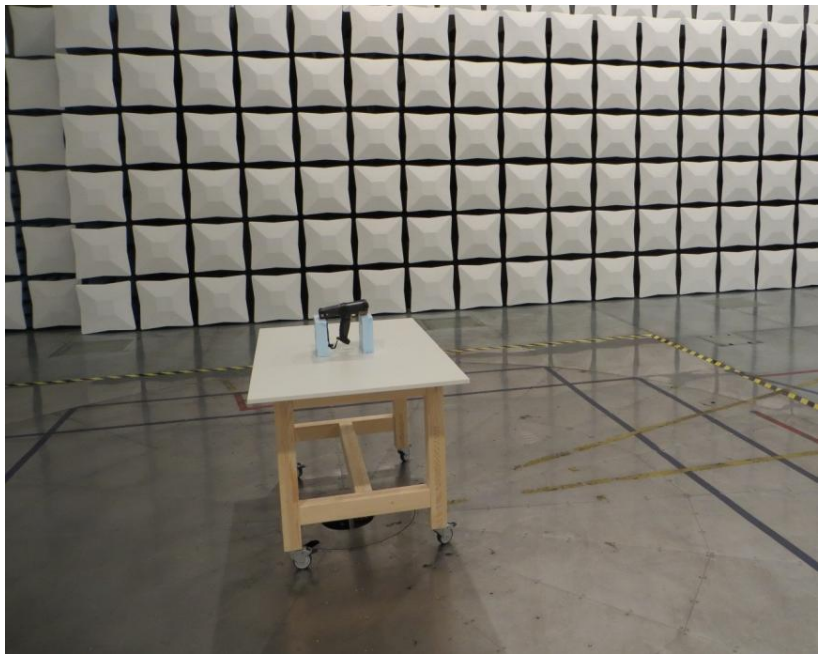
	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☒	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Semi anechoic room		No. 8	2057	---	Albatross

7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement

Test setup for radiated emission measurement (Semi anechoic room)





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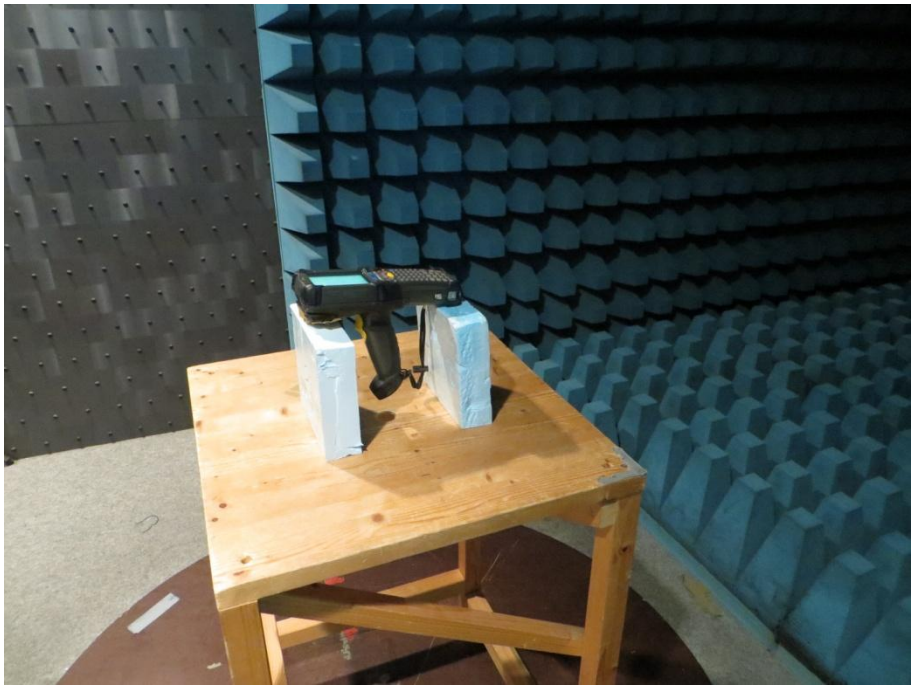
Web: www.tuev-sued.de

Test setup for radiated emission measurement (fully anechoic room)



8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.1046(a)	Conducted output power	--	Not applicable
2.202(a)	Occupied bandwidth		Not applicable
2.201, 2.202	Class of emission		Calculated
15.35(c)	Pulse train measurement for pulsed operation		Not applicable
15.205(a)	Restricted bands of operation		Not applicable
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	25	Not applicable
15.205(b) 15.209	Radiated emission 9 kHz to 30 MHz	27	Test passed
15.205(b) 15.209	Radiated emission 30 MHz to 40 GHz	34	Test passed

IC RSS-GEN Issue 4			
Section(s)	*Test*	*Page*	*Result*
6.12	Transmitter output power (conducted)	--	Not applicable
6.10	Pulsed operation		Not applicable
8.8	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	--	Not applicable
8.10(a) / 6.13	Restricted bands and unwanted emission frequencies		Not applicable
8.10(b)(c) 8.9	Unwanted emissions 9 kHz to 30 MHz	27	Test passed
8.10(b)(c) 8.9	Unwanted emissions 30 MHz to 40 GHz	34	Test passed

8.1 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

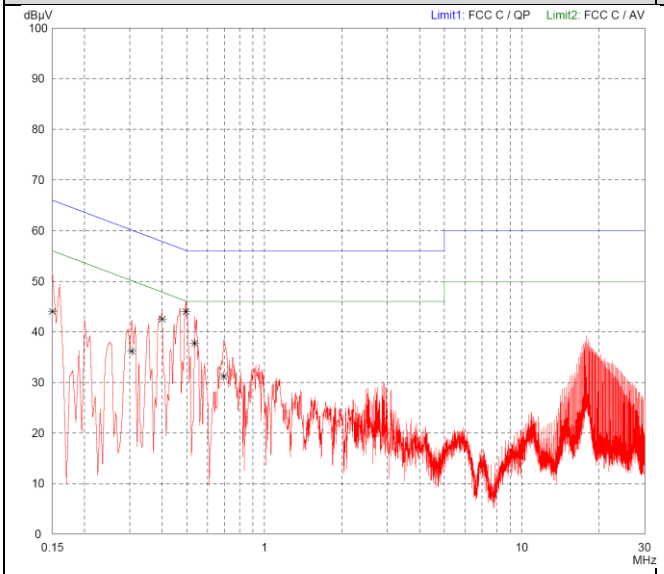
Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-GEN Issue 4, section 8.10		
Guide:	ANSI C63.4 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dBµV)	
		Quasi-peak	Average
	0.15 - 0.5	66 to 56	56 to 46
	0.5 - 5	56	46
	5 - 30	60	50
Measurement procedure:	Conducted AC Powerline Emission (6.1)		

Comment:	Mobile Computer in cradle, RFID reader switched off automatically by operating system
Date of test:	November 20, 2014
Test site:	Shielded room, cabin no. 1

Test Result:	Test passed

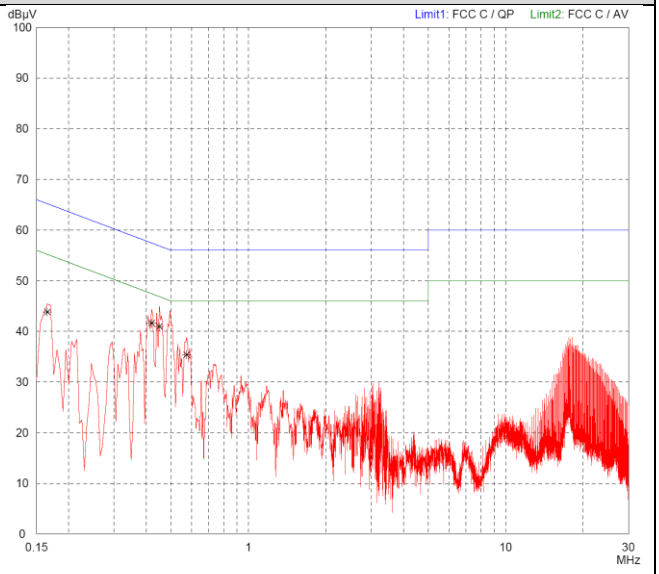
Tested on:	AC Input of the charging cradle,

Live Wire



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV
0.150	44.0		44.0	66.0
0.305	36.2		36.2	60.1
0.400	42.5		42.5	57.9
0.495	44.0		44.0	56.1
0.535	37.8		37.8	56.0
0.695	31.2		31.2	56.0

Neutral Wire



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV
0.165	43.8		43.8	65.2
0.420	41.6		41.6	57.4
0.450	41.0		41.0	56.9
0.575	35.4		35.4	56.0

Sample calculation of final values:

Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

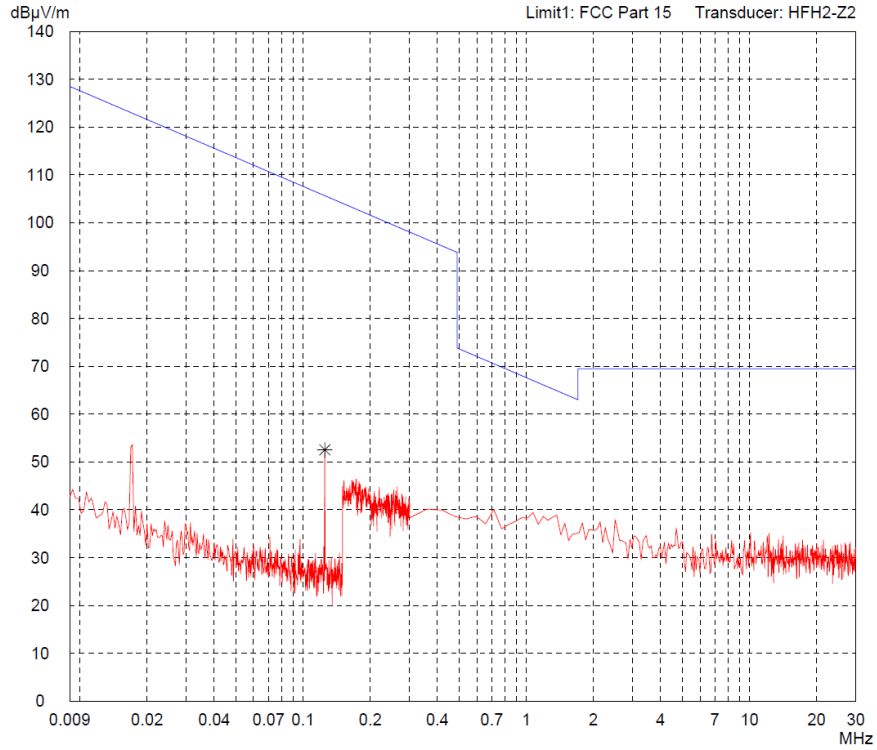
8.2 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.209 IC RSS-GEN Issue 4, sections 8.10(b)(c) and 8.9			
Guide:	ANSI C63.4			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
	0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
	1.705 - 30.000	30	29.5	30
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.2)			

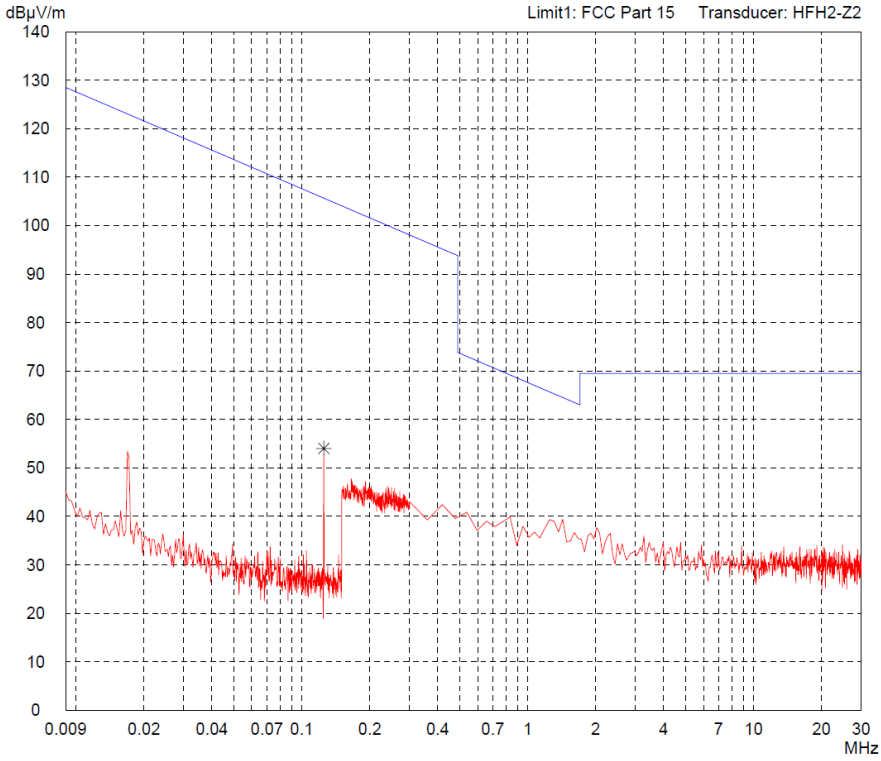
Comment:	Prescan performed at 3 m test distance
	Test Mode (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Open field test site, prescan in fully anechoic chamber

Test Result:	Test passed

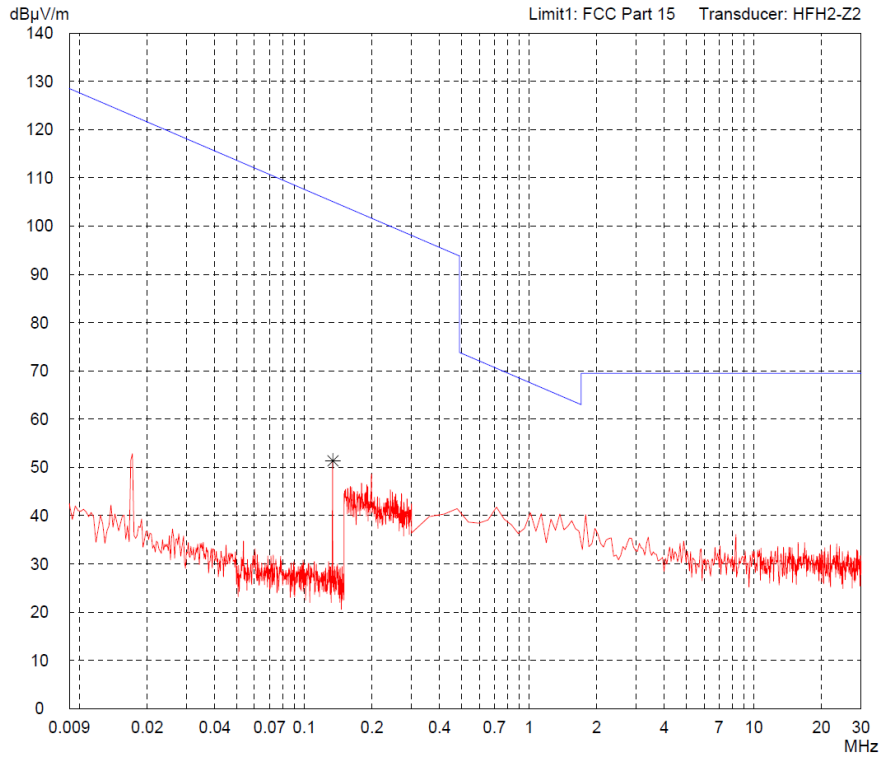
Test mode 1:



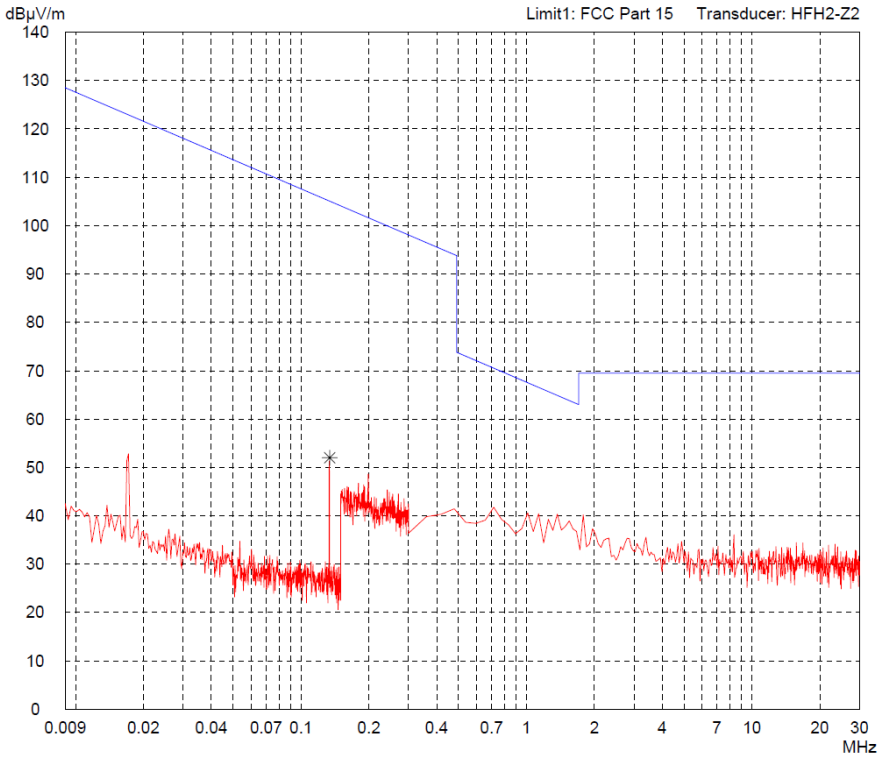
Test mode 2:



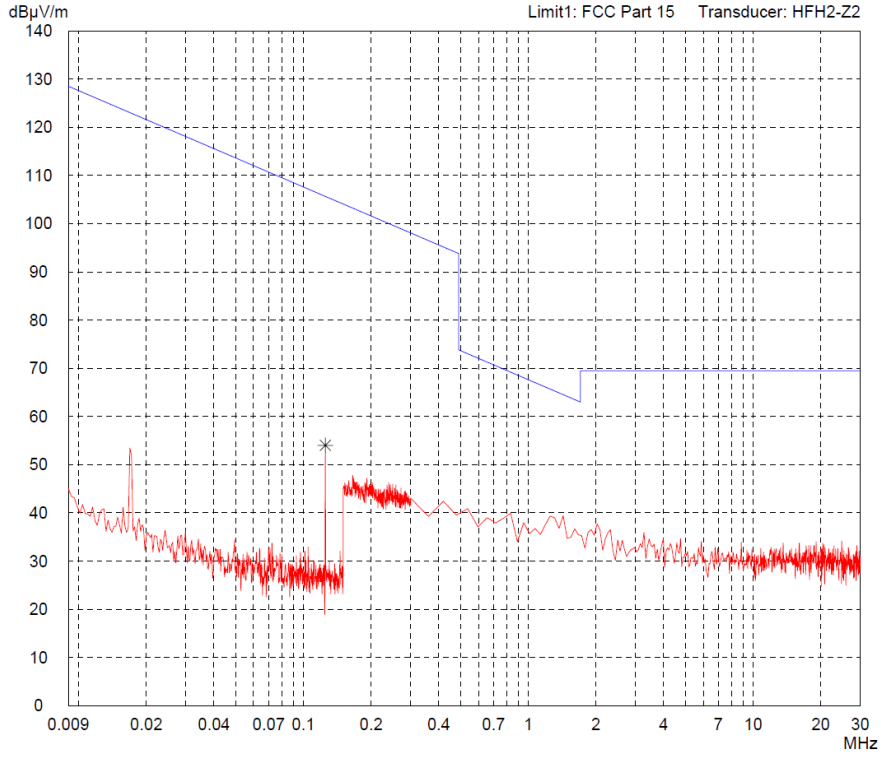
Test mode 3:



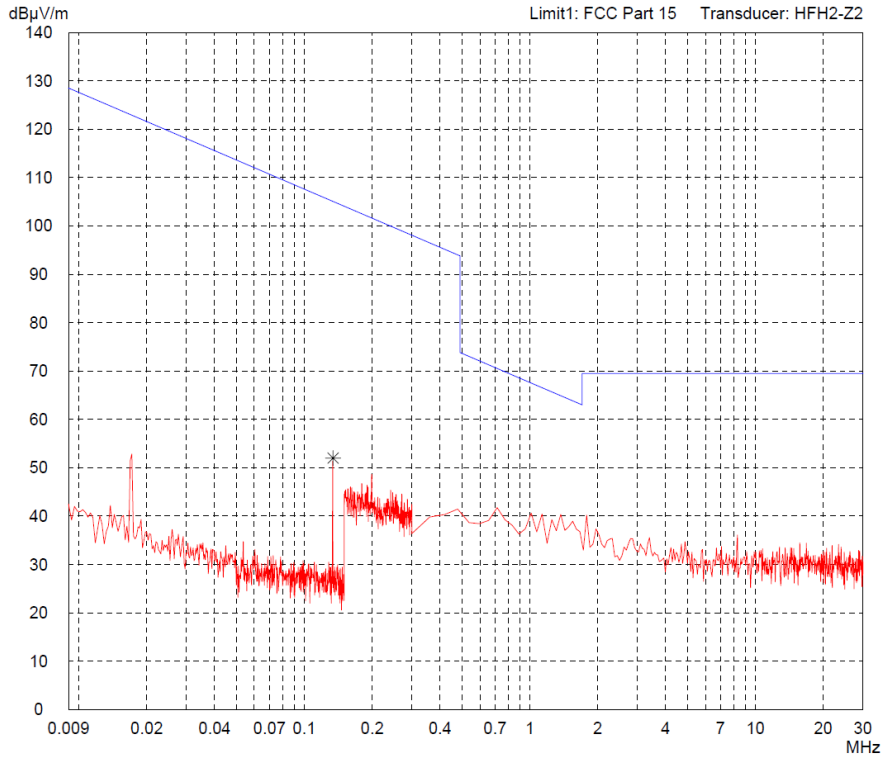
Test mode 4:



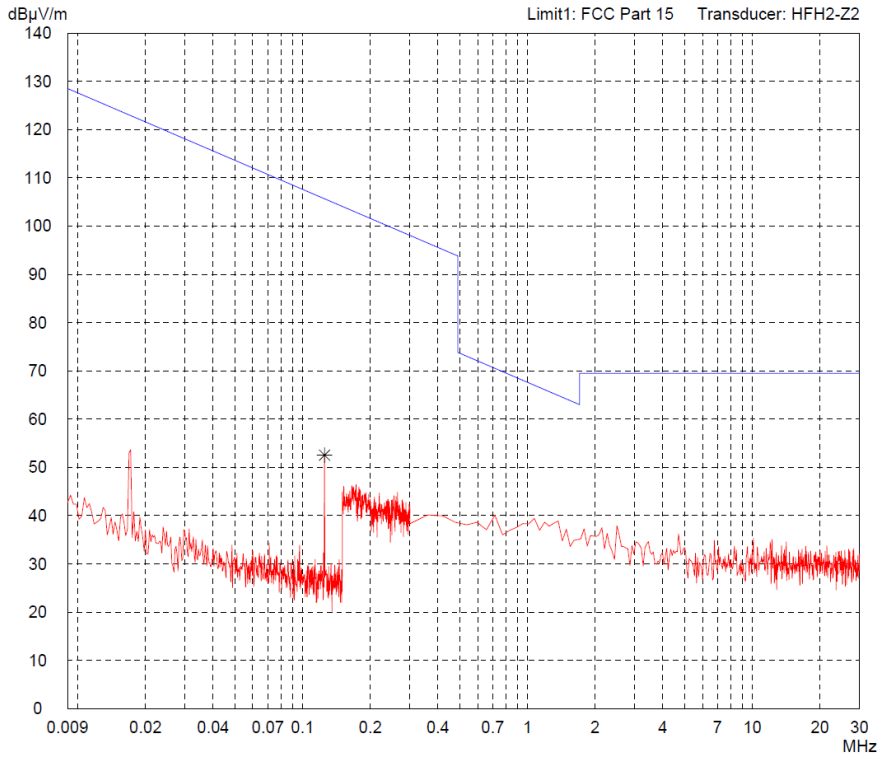
Test mode 5:



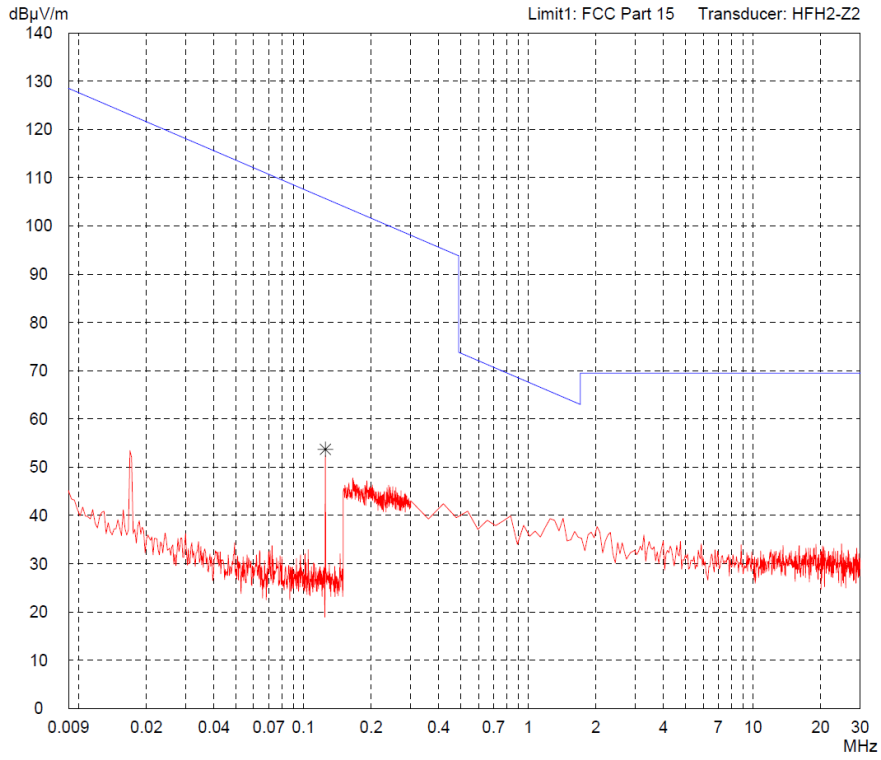
Test mode 6:



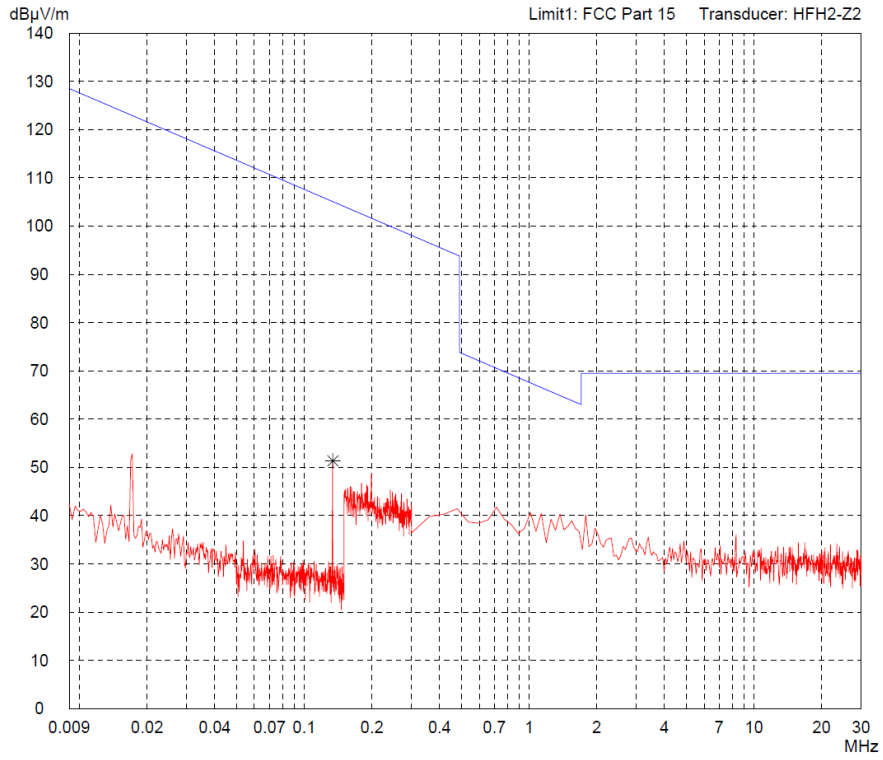
Test mode 7:



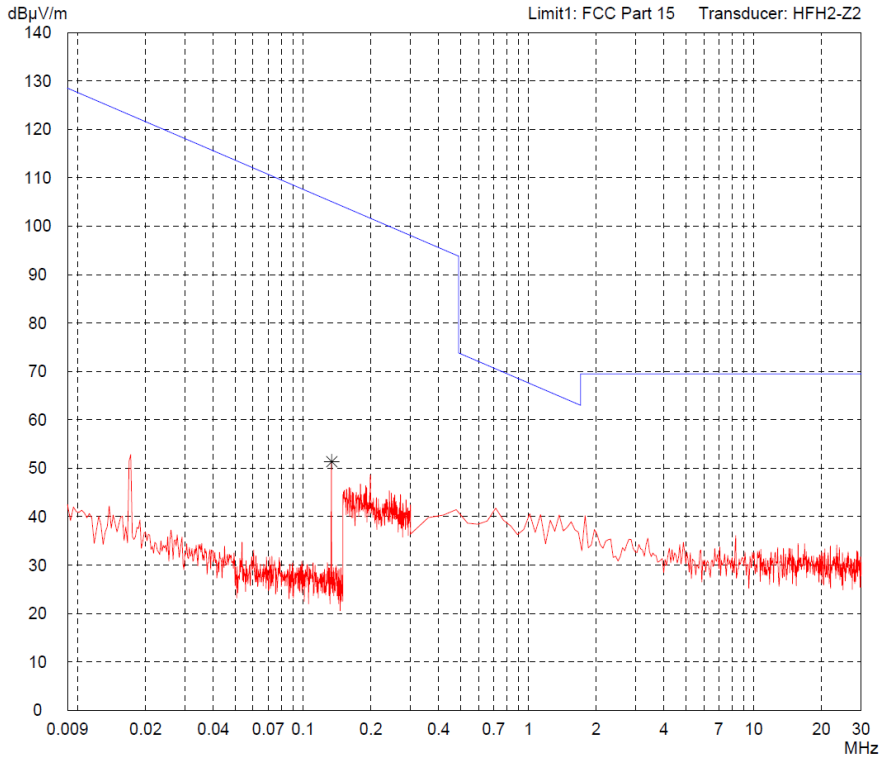
Test mode 8:



Test mode 9:



Test mode 10:



Sample calculation of final values:

$$\text{Extrapolation Factor (dB/decade)} = \begin{cases} -40 \text{ (dB/decade)} & \text{if } d_1 = d_2 \\ \dfrac{\text{Reading Value } d_2 \text{ (dBµV)} - \text{Reading Value } d_1 \text{ (dBµV)}}{\text{Log}(d_2) - \text{Log}(d_1)} & \text{if } d_1 \neq d_2 \end{cases}$$

$$\text{Extrapolation Factor (dB)} = (\text{Log}(d) - \text{Log}(d_2)) \cdot \text{Extrapolation Factor (dB/decade)}$$

$$\text{Final Value (dBµV/m)} = \text{Reading Value } d_2 \text{ (dBµV)} + \text{Correction Factor (dB/m)} + \text{Extrapolation Factor (dB)} + \text{Pulse Train Correction (dB)}$$

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

8.3 Radiated Emission Measurement 30 MHz to 40 GHz

Rules and specifications:	CFR 47 Part 15, section 15.209 IC RSS-GEN Issue 4, section 8.9		
Guide:	ANSI C63.4		
Limit:	Frequency of Emission (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
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.3) Radiated Emission at Alternative Test Site (6.4)		

Comment:	Test Mode 1 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

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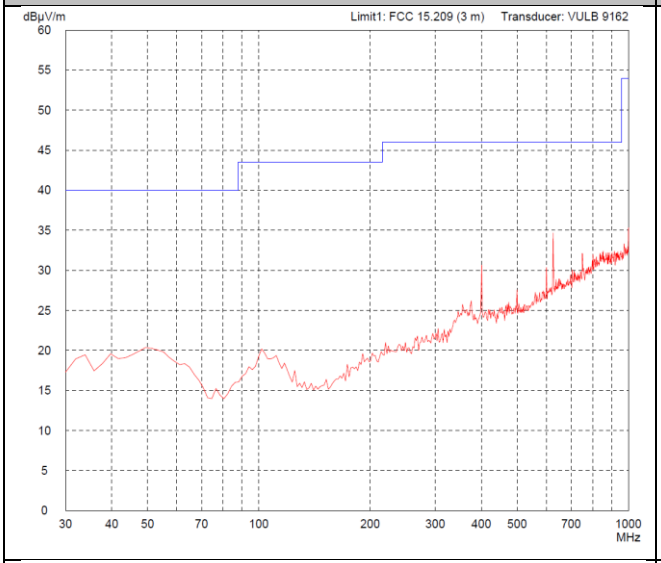
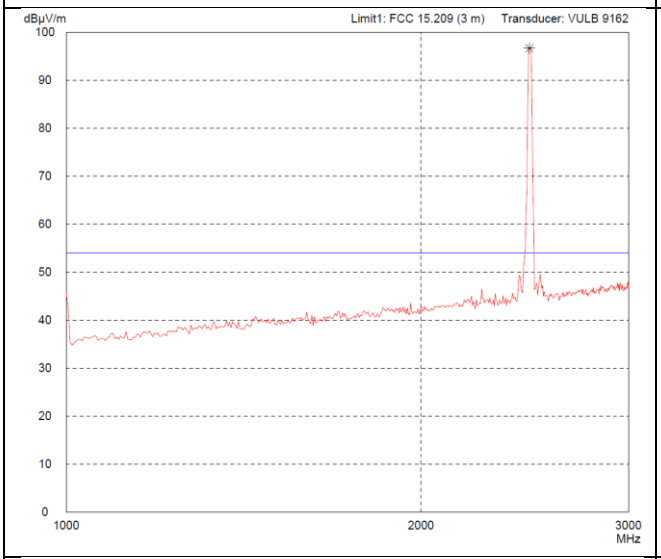
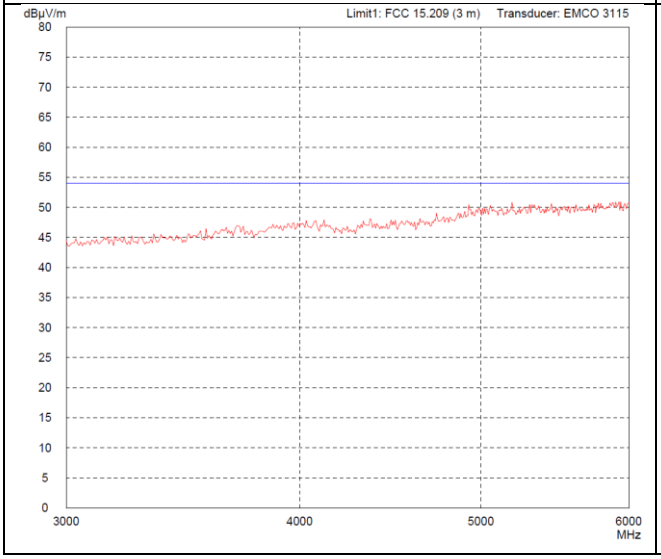
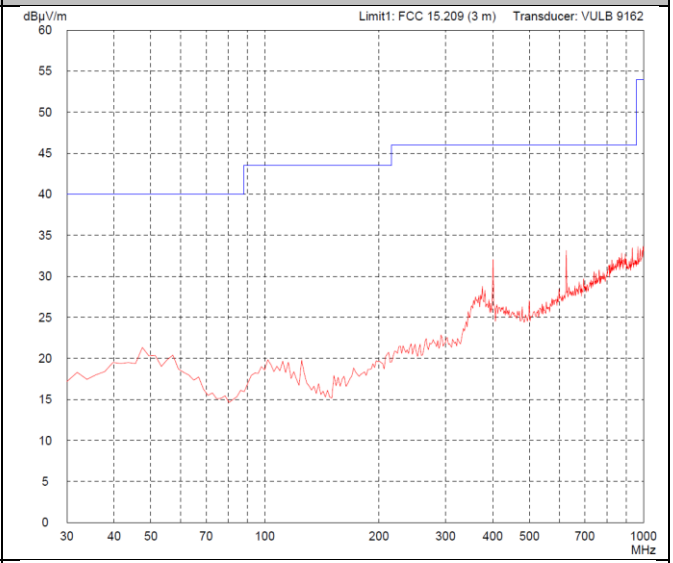
Horizontal Polarisation

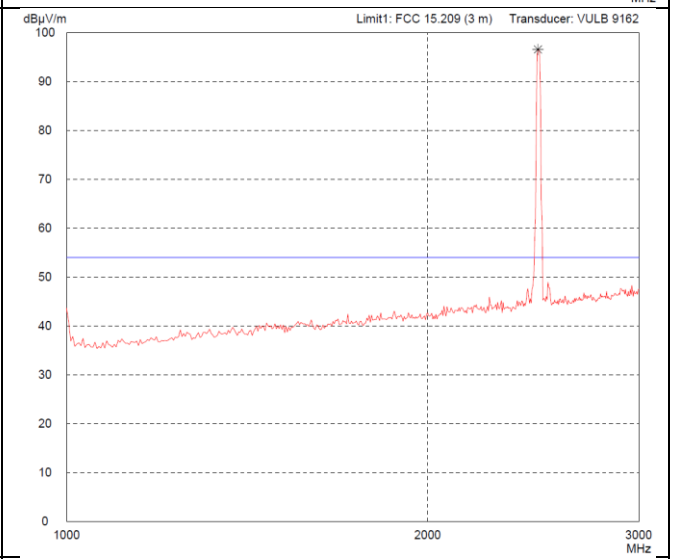


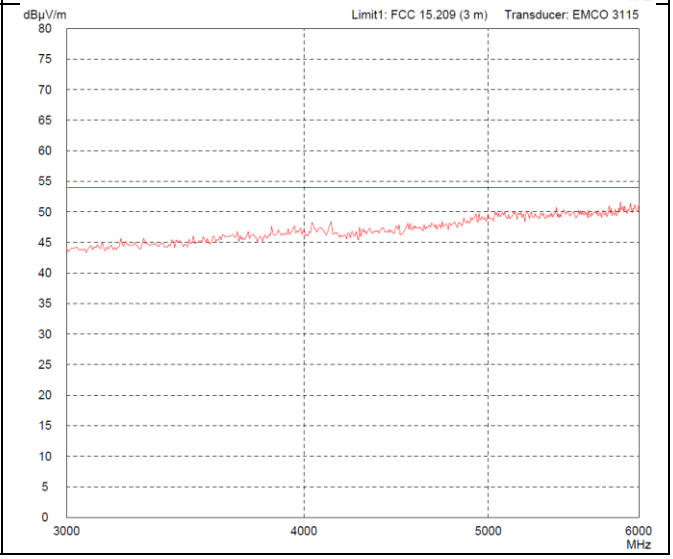


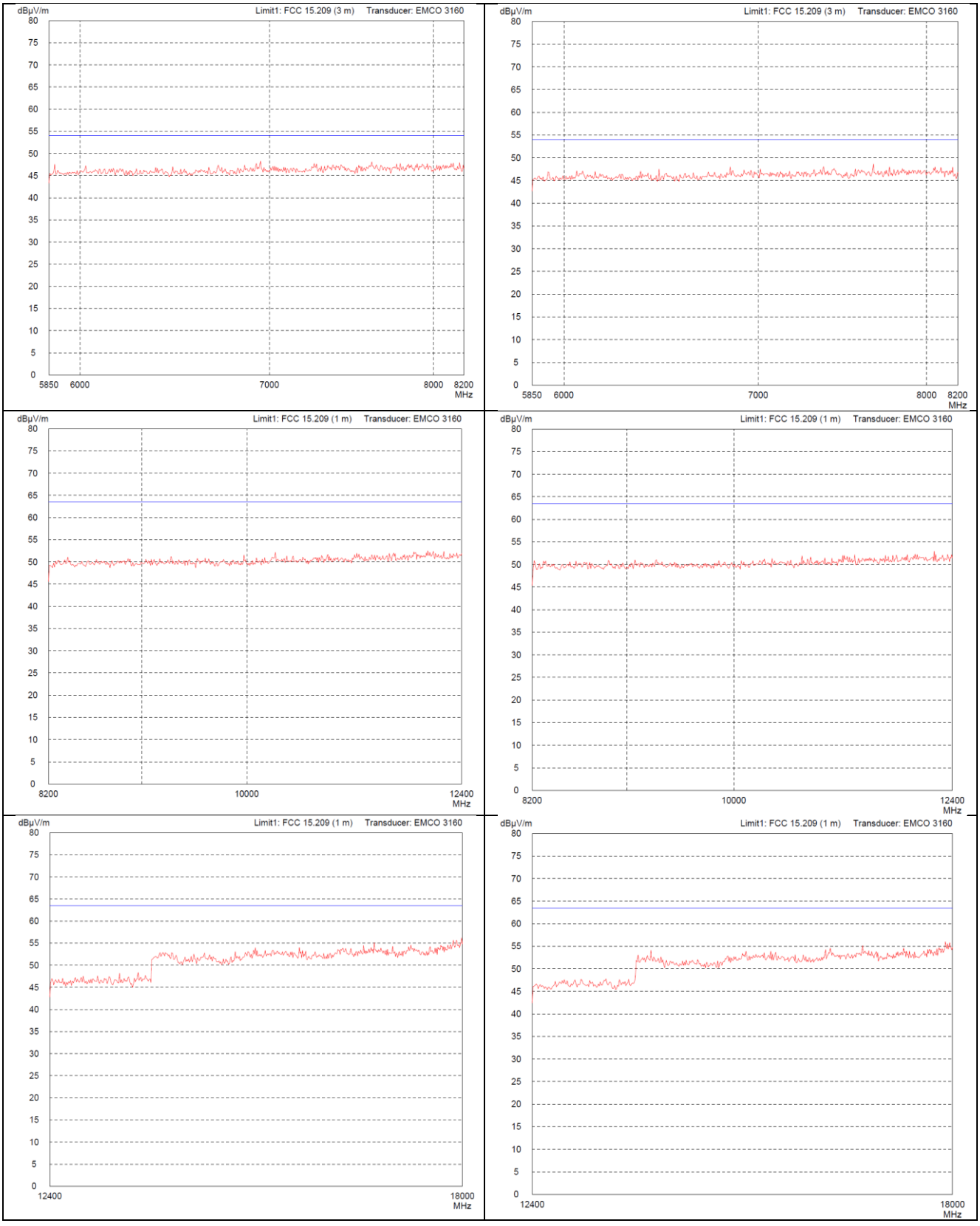


Vertical Polarisation







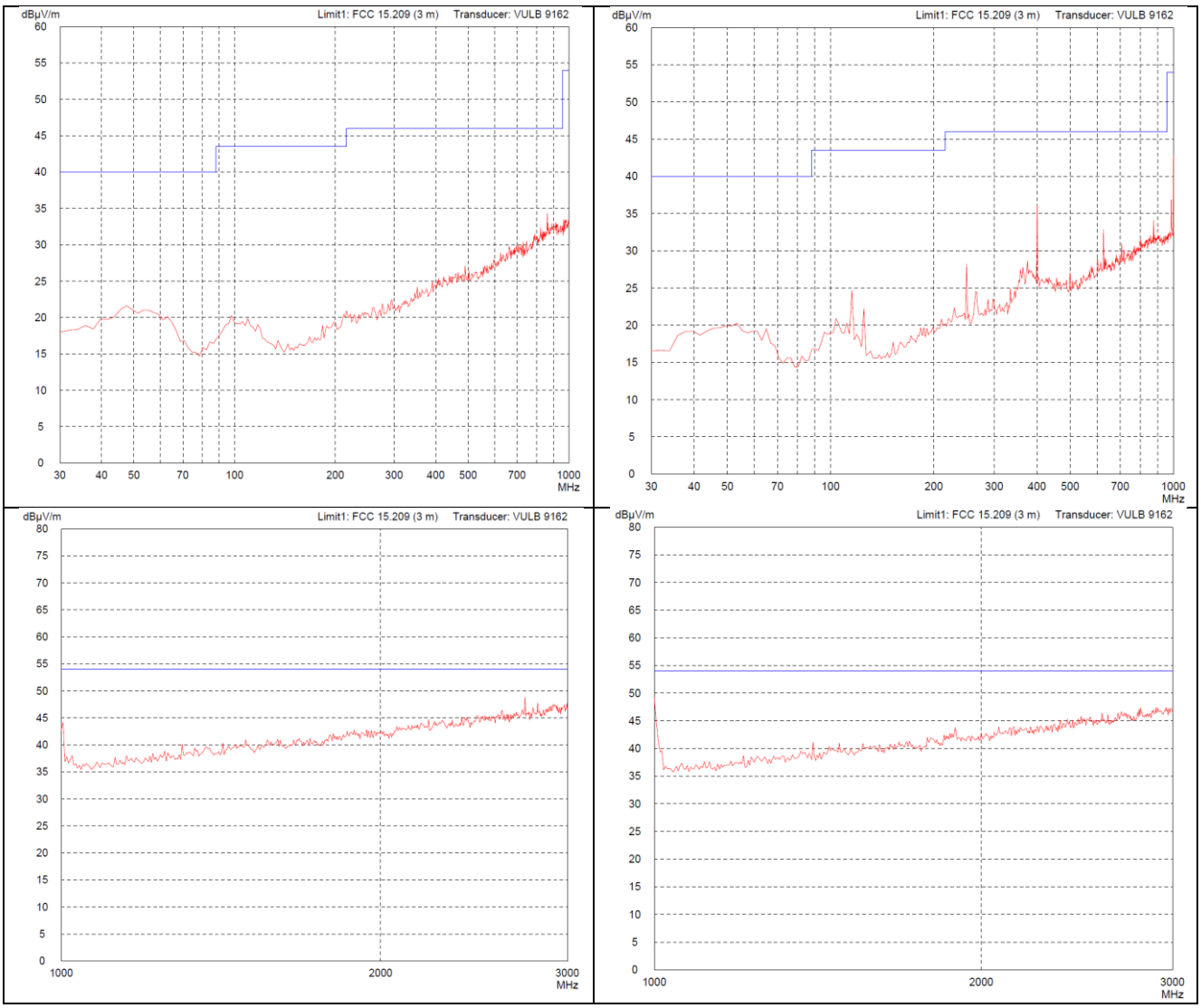

dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3160
5850 6000 7000 8000 8200 MHz
dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3160
5850 6000 7000 8000 8200 MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
8200 10000 12400 MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
8200 10000 12400 MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
12400 18000 MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
12400 18000 MHz

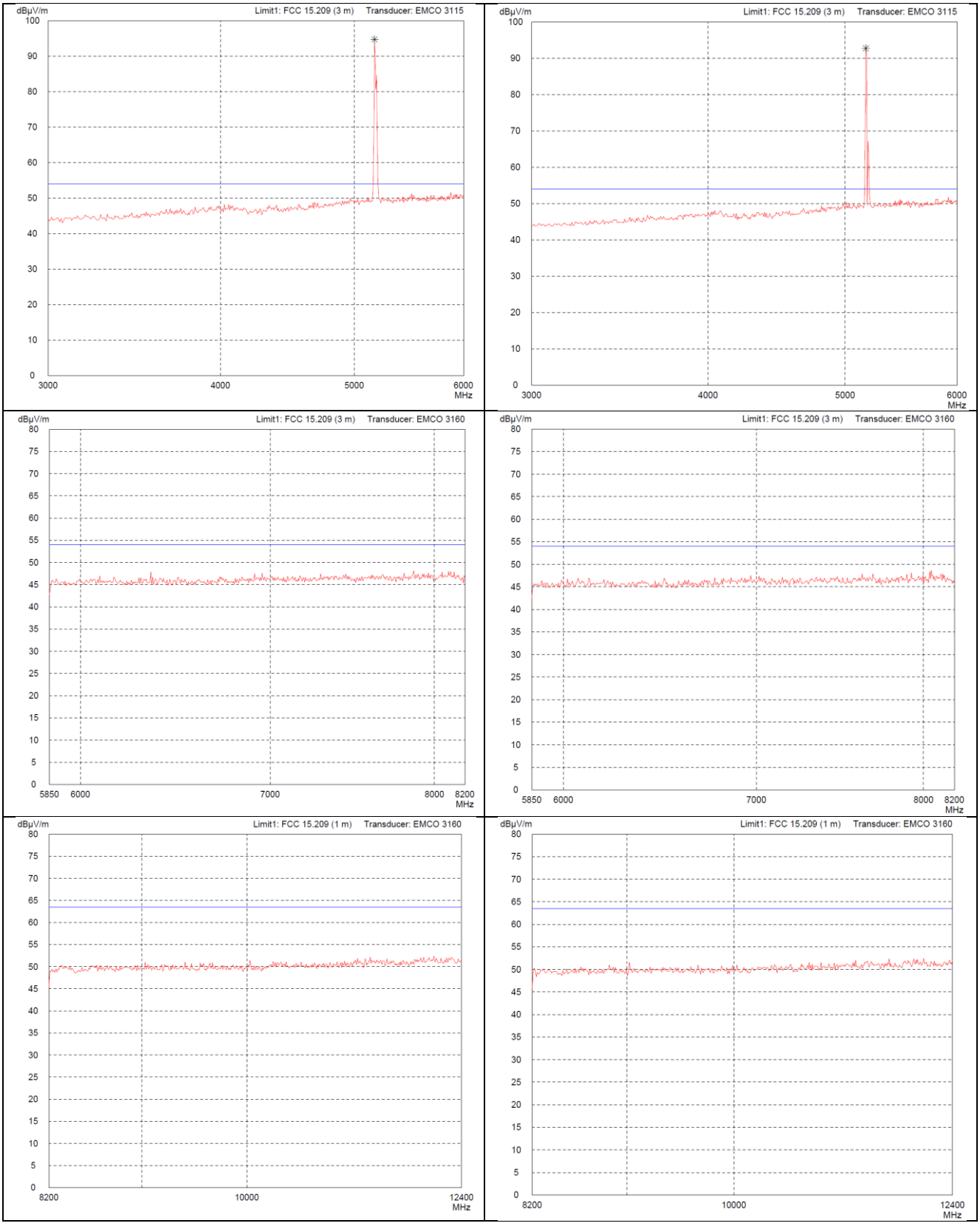
Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 2 (see section 5)
Date of test:	November 19 to 24, 2014, September 14, 2015
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed




dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3115
MHz
dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3115
MHz
dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3160
MHz
dBµV/m
Limit1: FCC 15.209 (3 m)
Transducer: EMCO 3160
MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
MHz
dBµV/m
Limit1: FCC 15.209 (1 m)
Transducer: EMCO 3160
MHz

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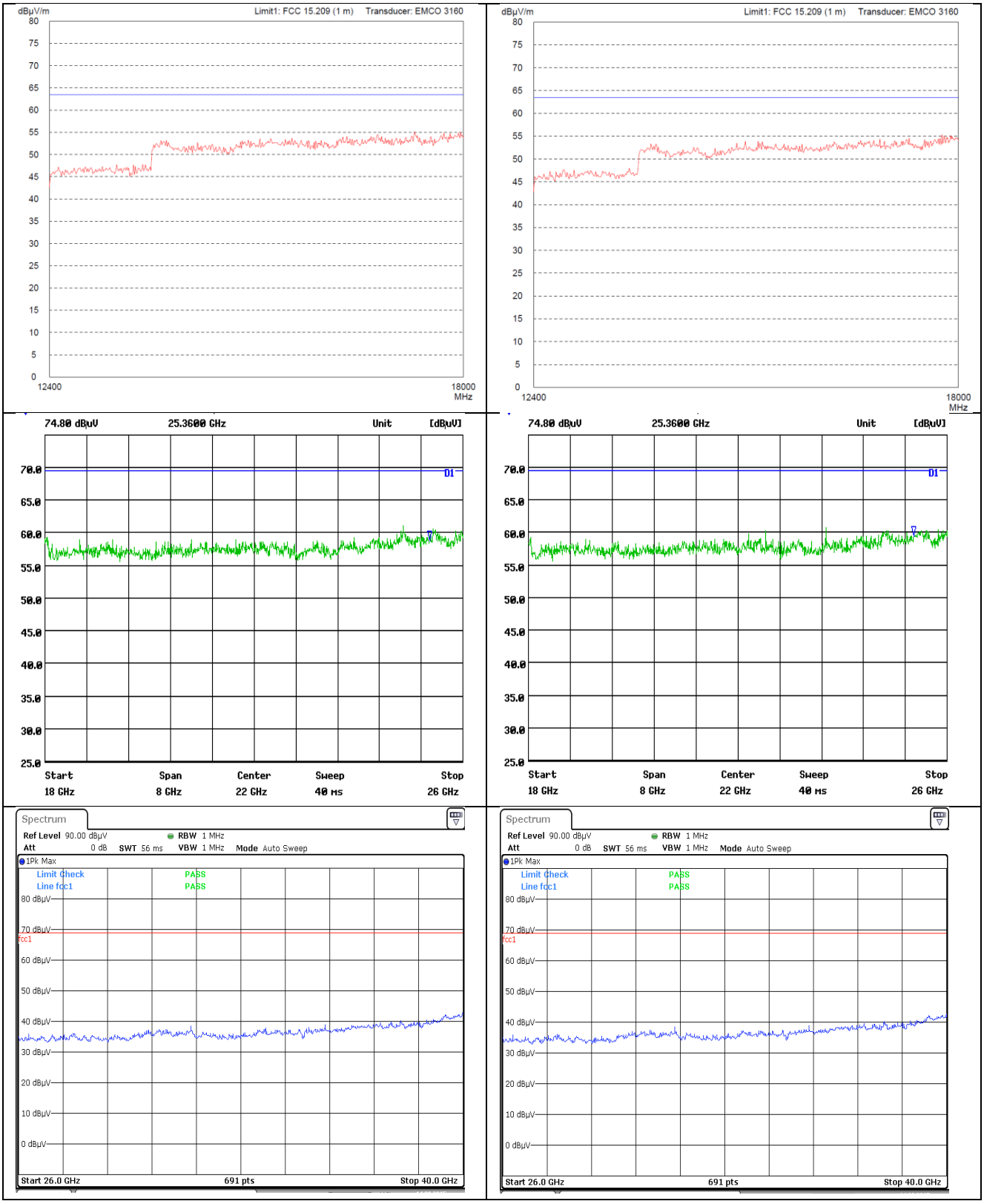
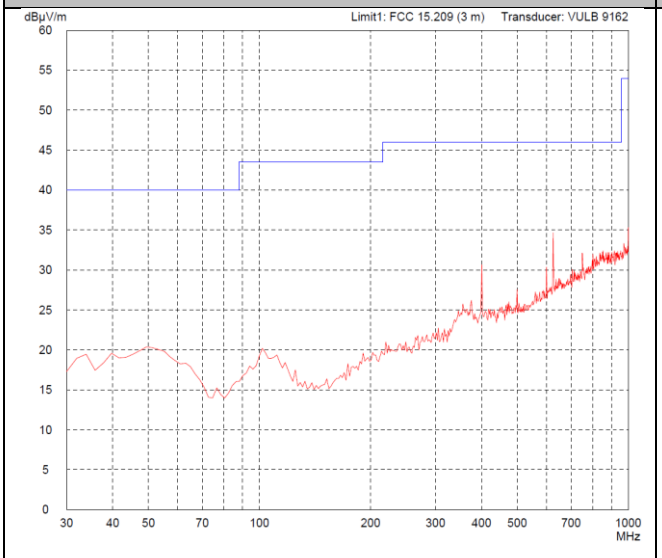
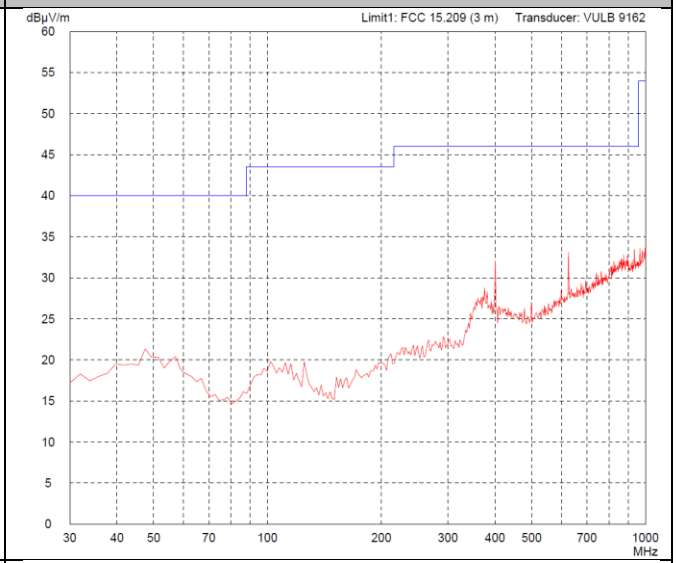
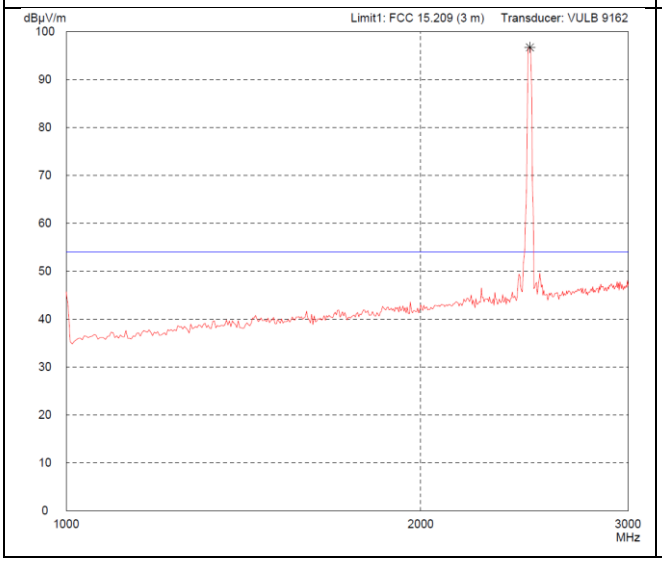
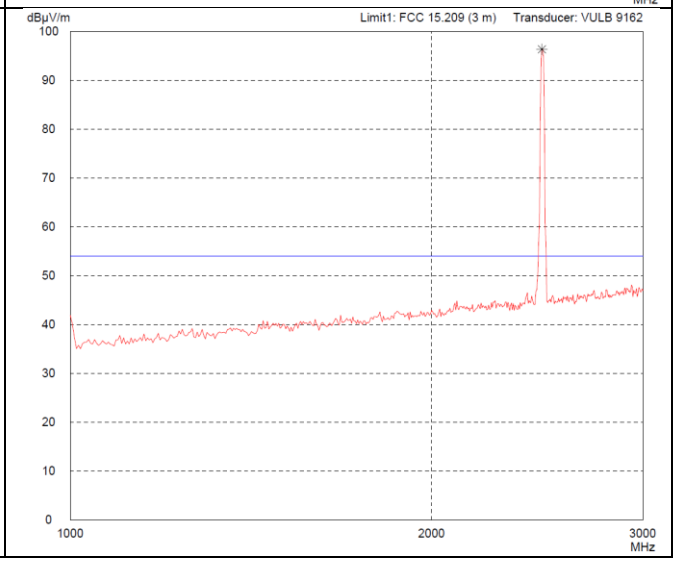


Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 3 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

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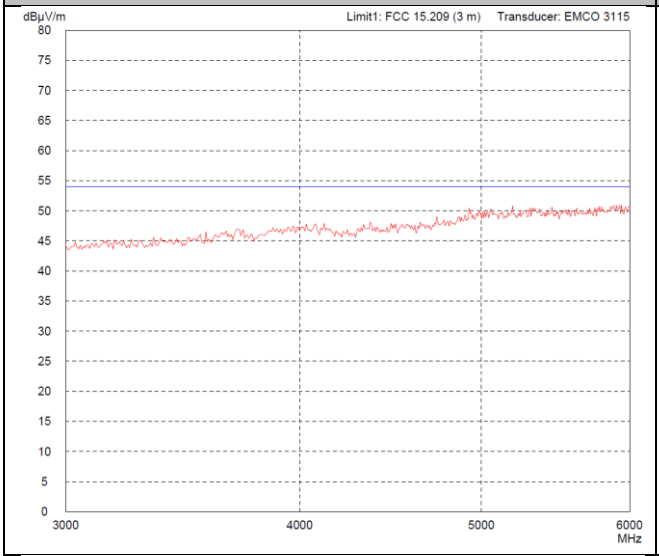
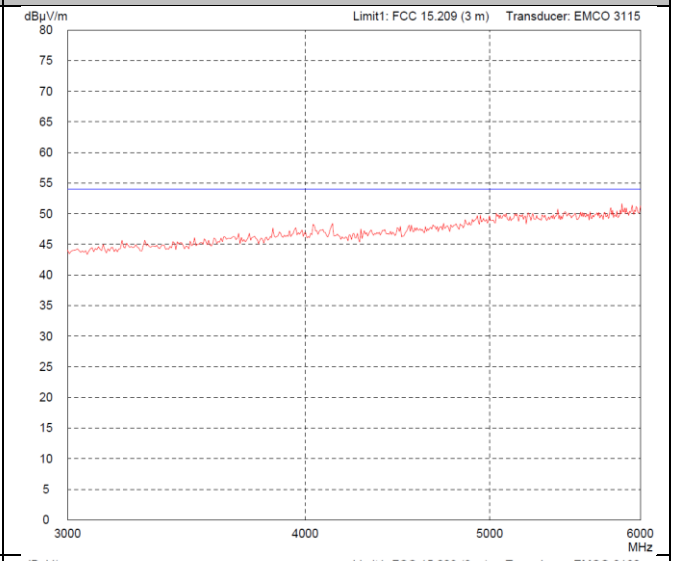
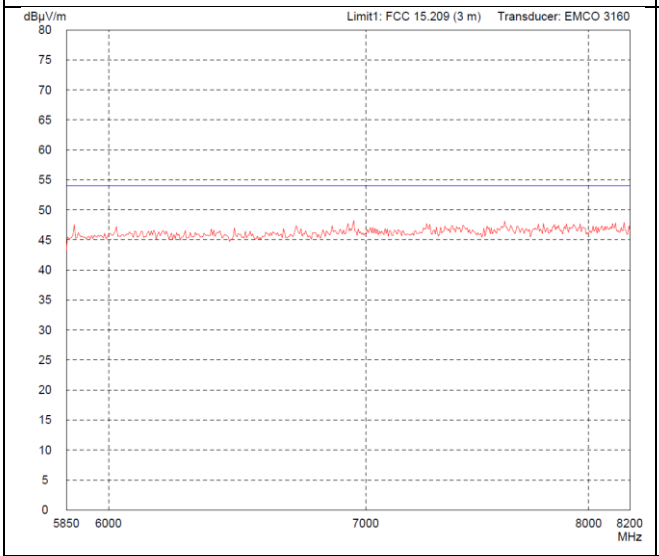
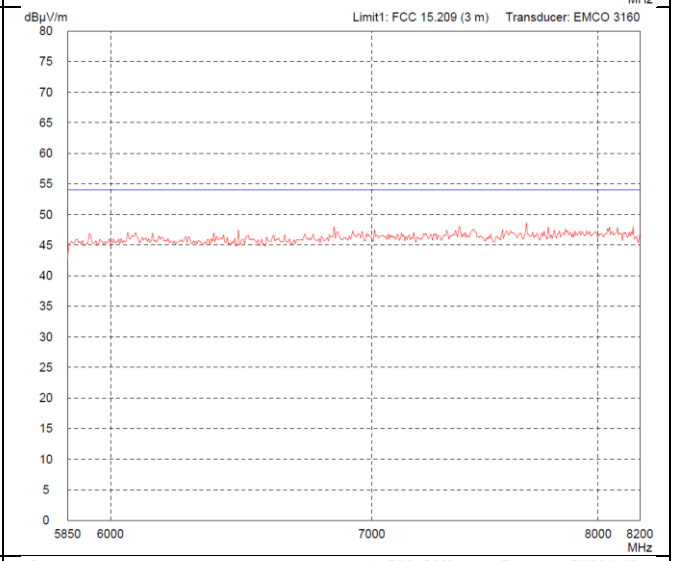
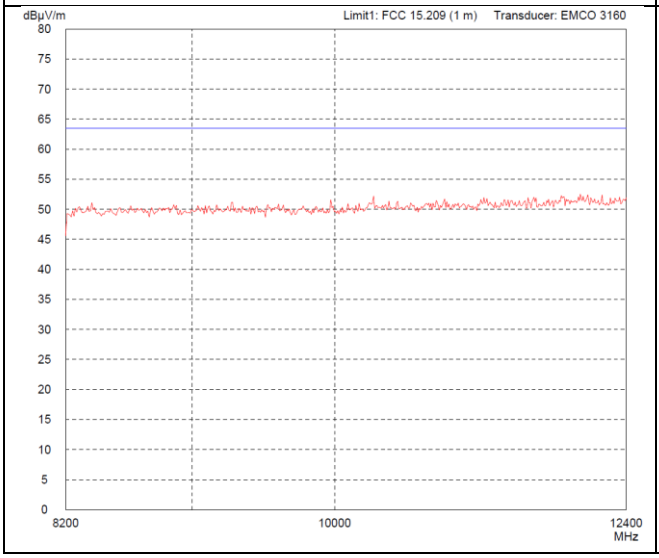
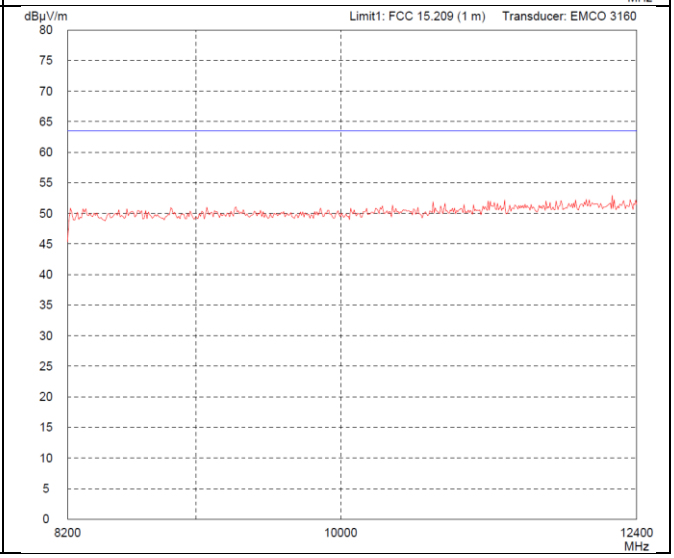
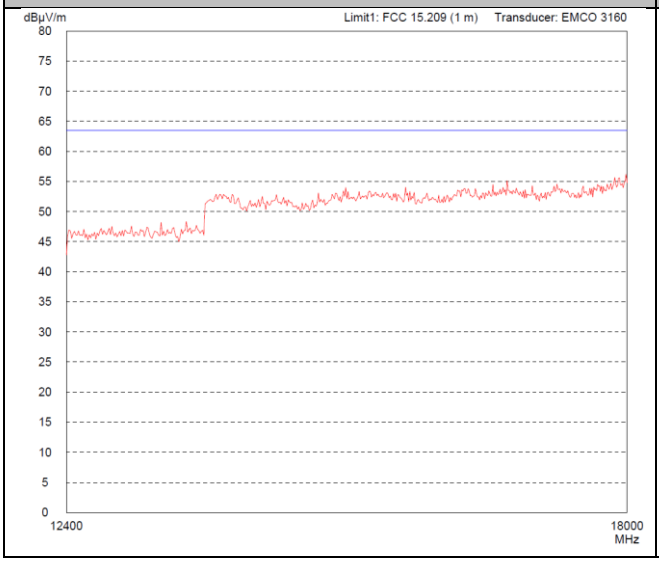
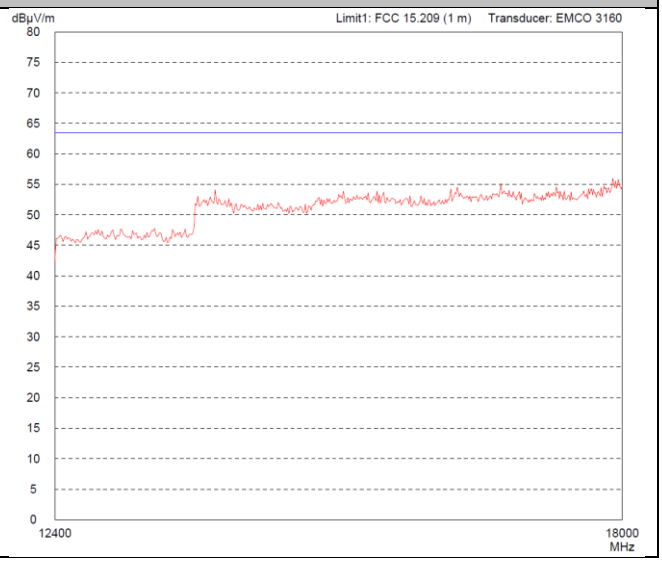
Horizontal Polarisation	Vertical Polarisation
	
	
	

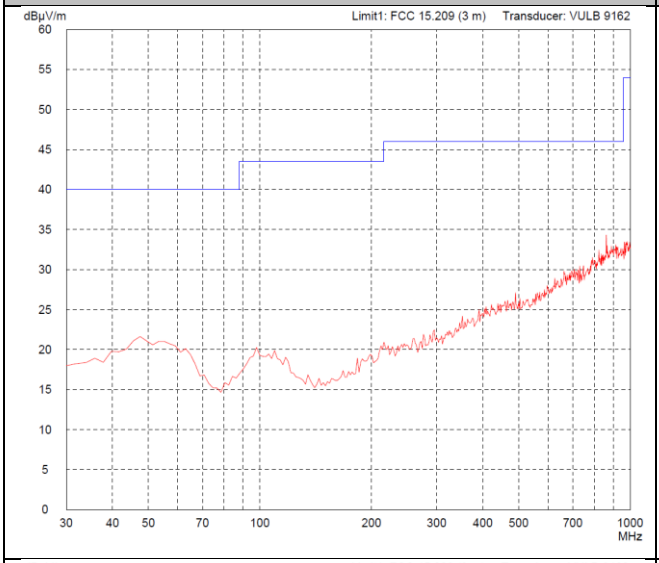
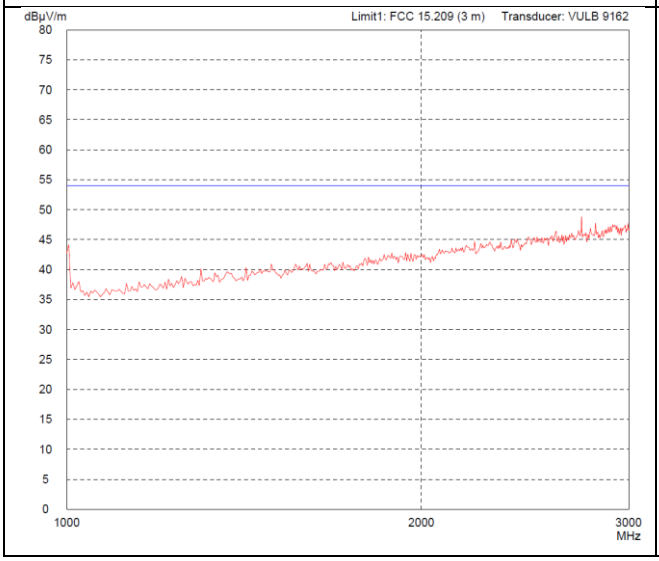
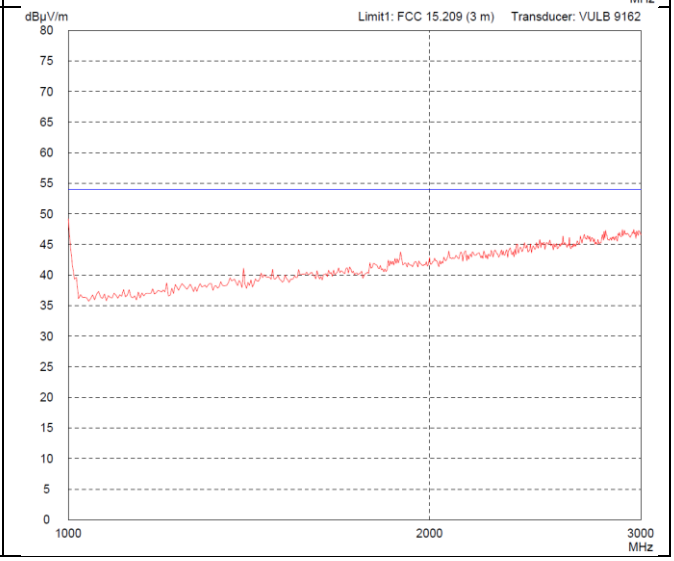
Horizontal Polarisation	Vertical Polarisation
	

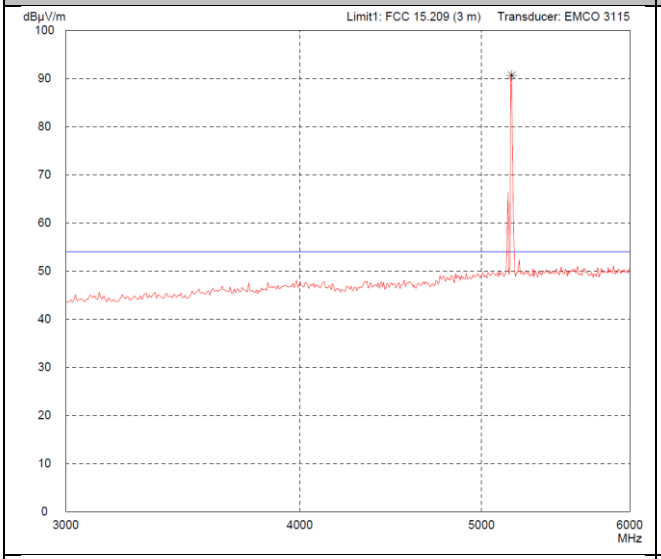
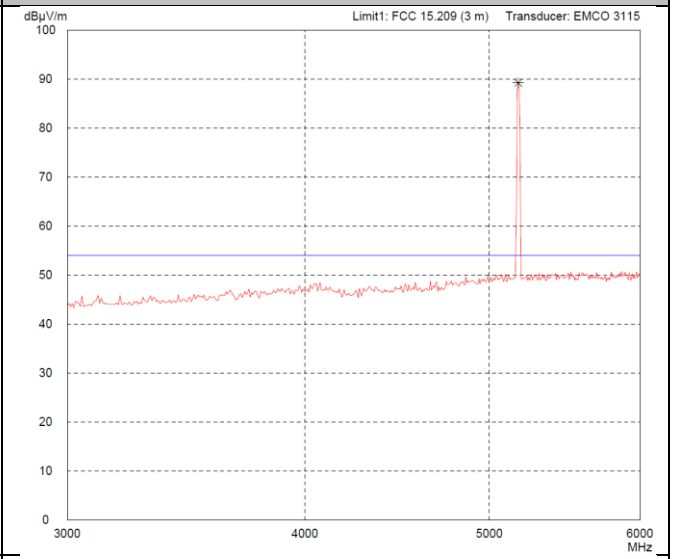
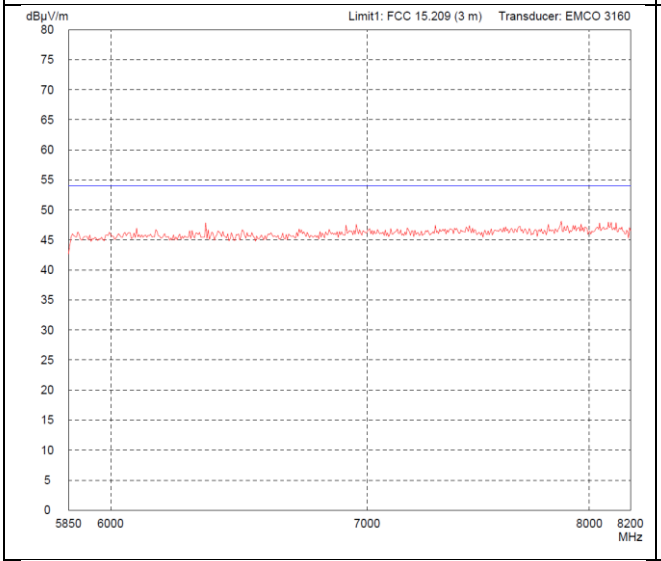
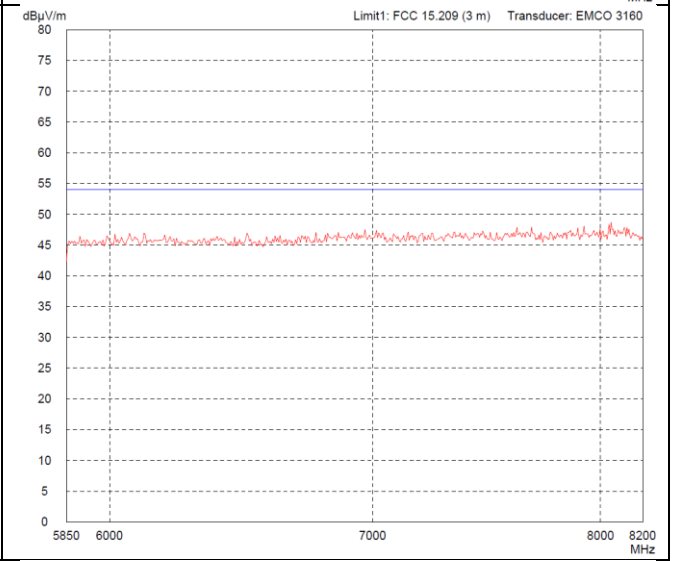
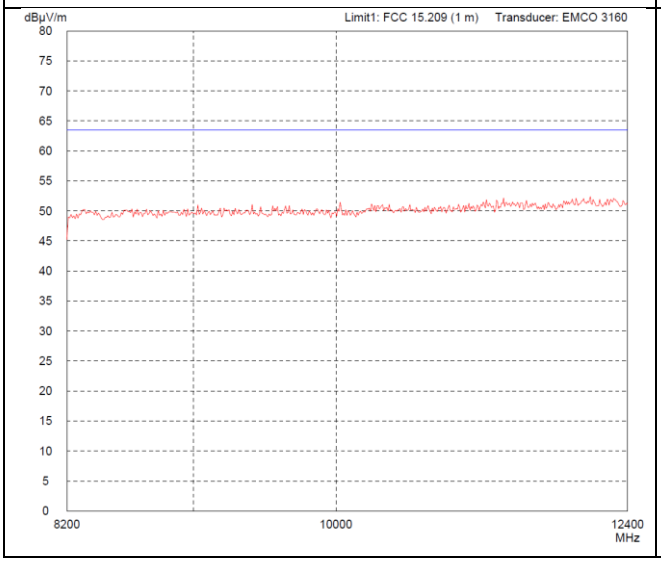
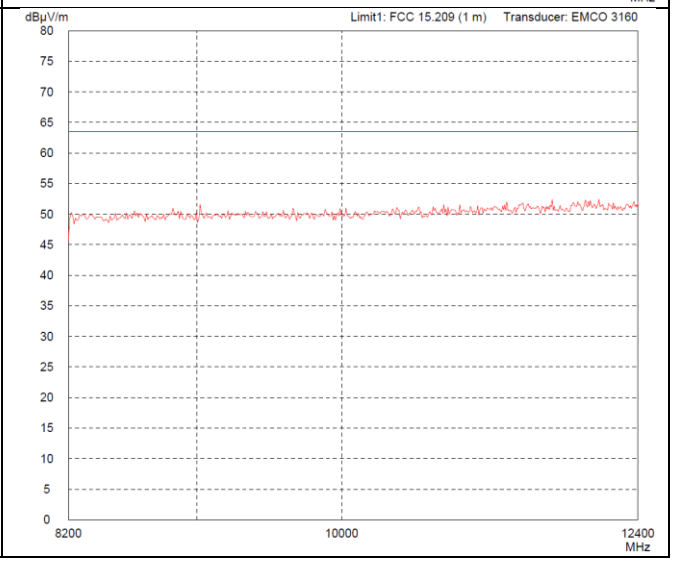
Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 4 (see section 5)
Date of test:	November 19 to 24, 2014, September 14, 2015
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

Horizontal Polarisation	Vertical Polarisation
	
	
	

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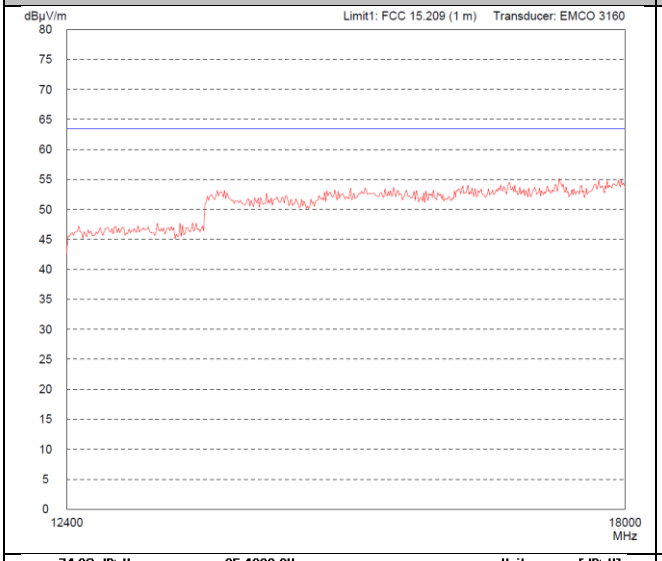
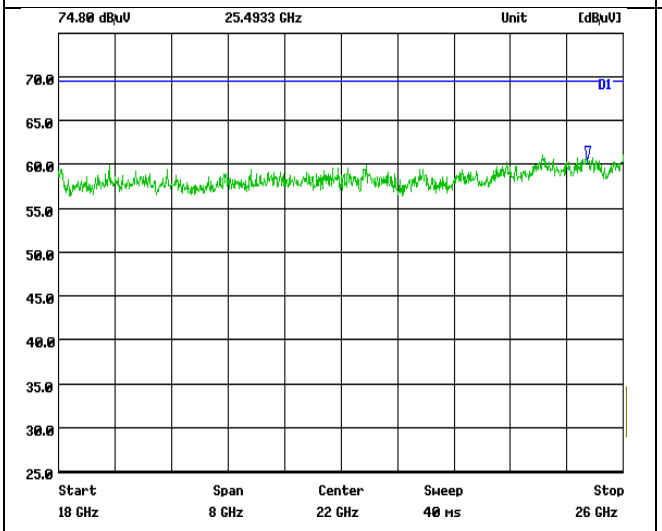
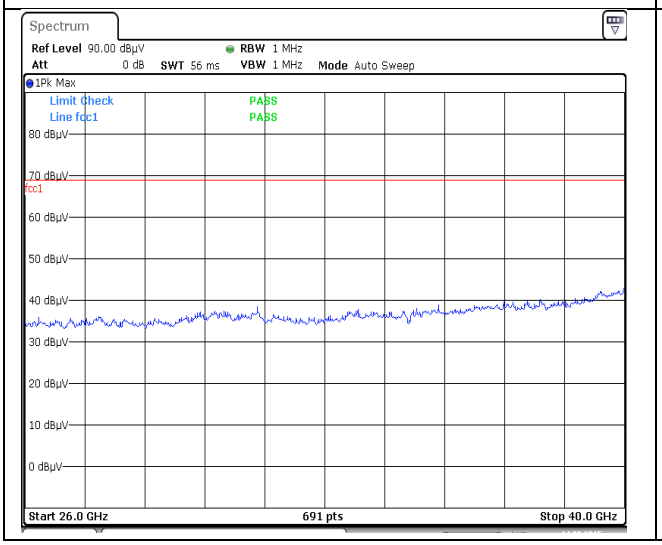
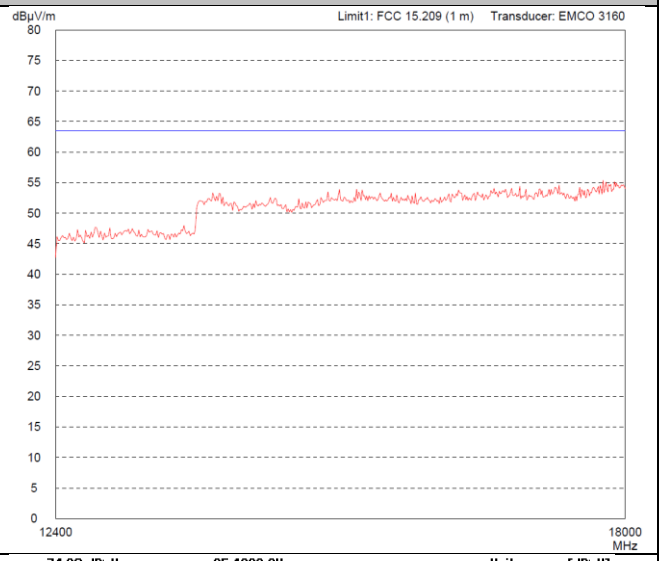
Horizontal Polarisation

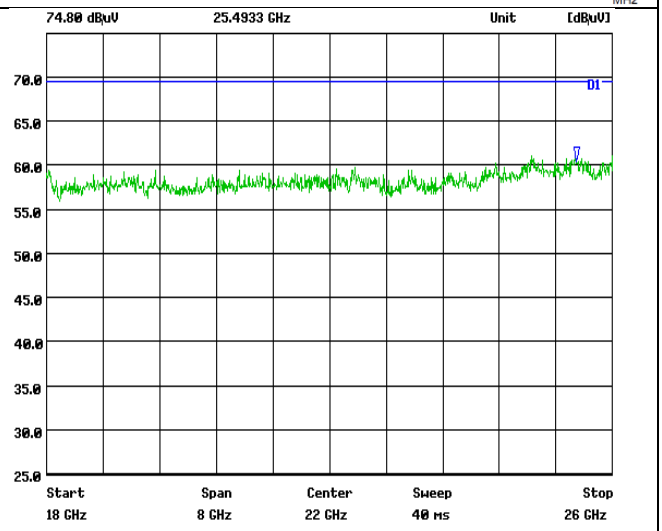


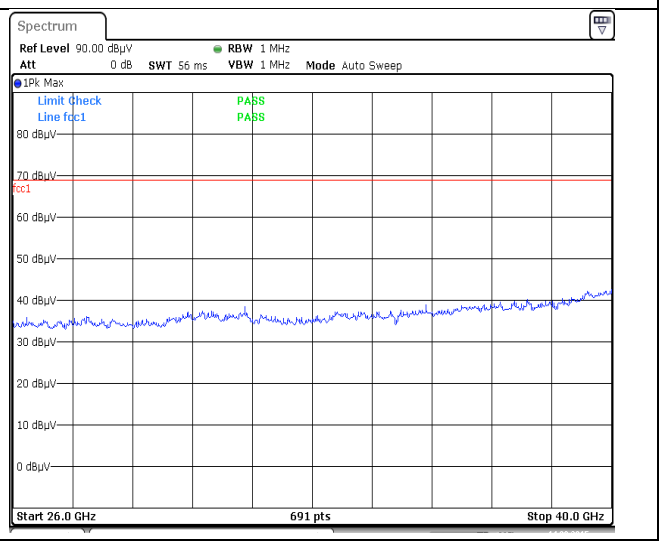




Vertical Polarisation





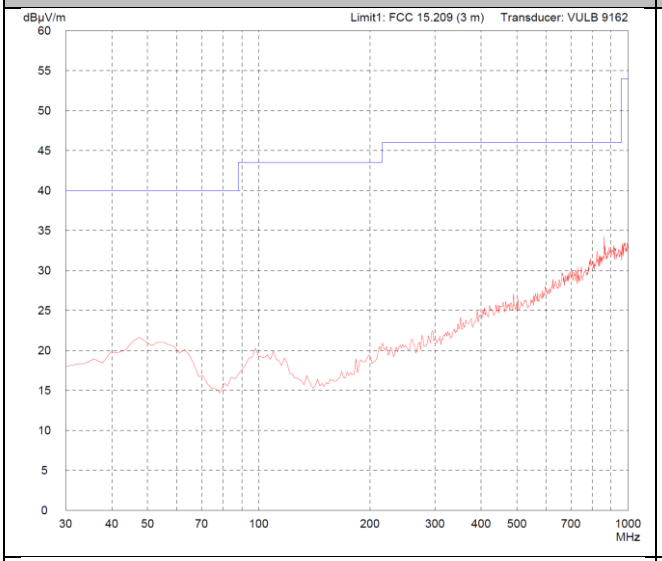
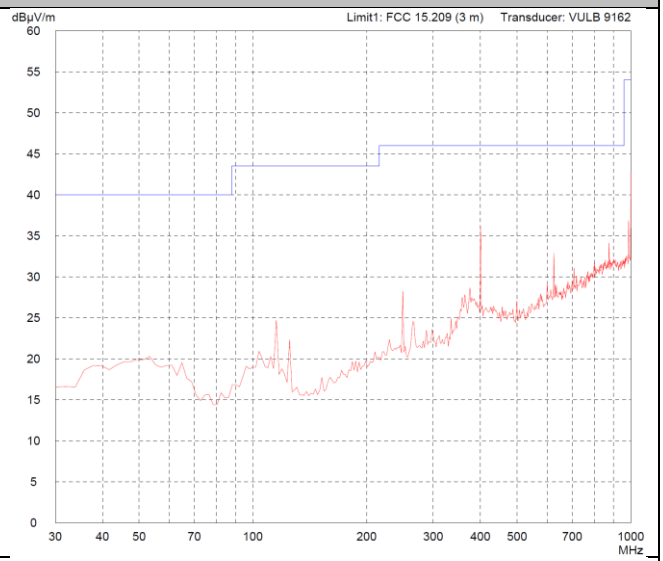
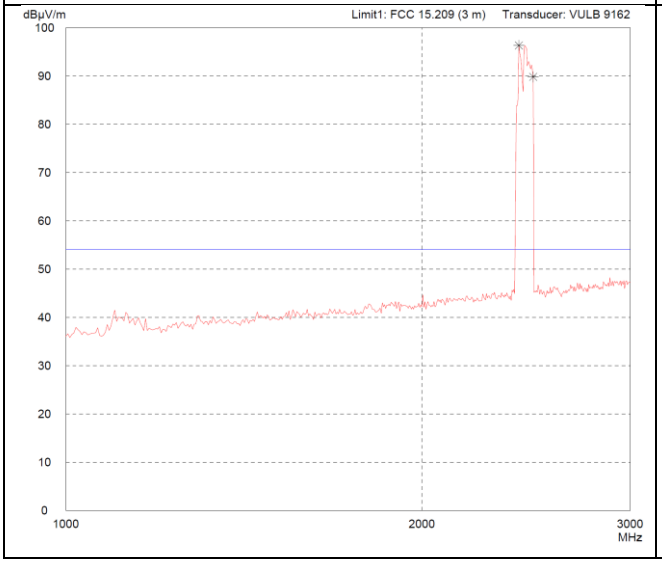
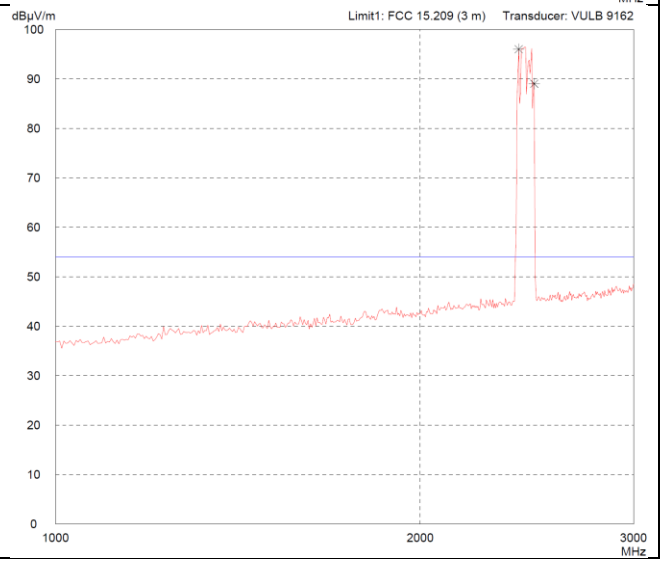


Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 5 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

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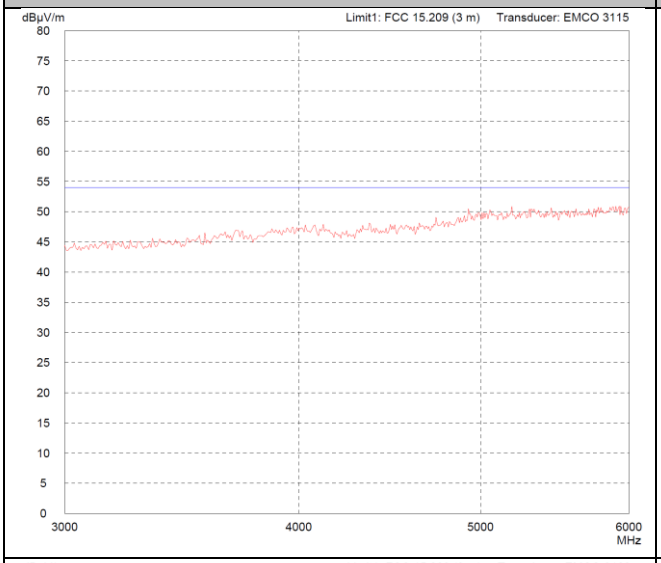
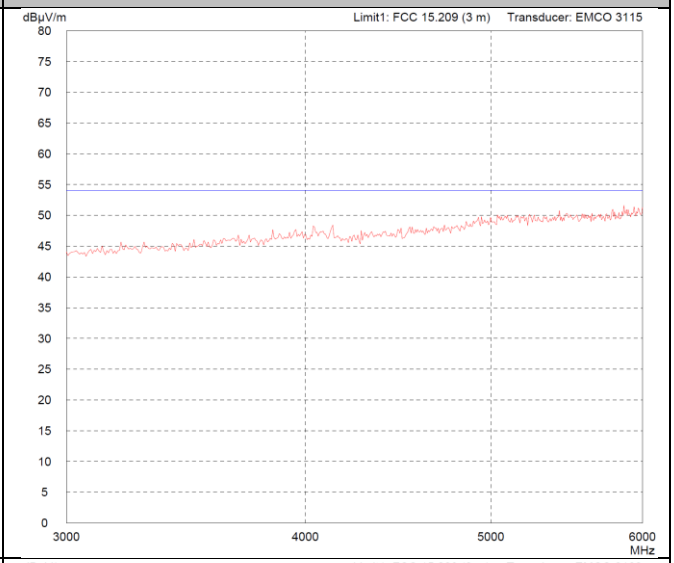
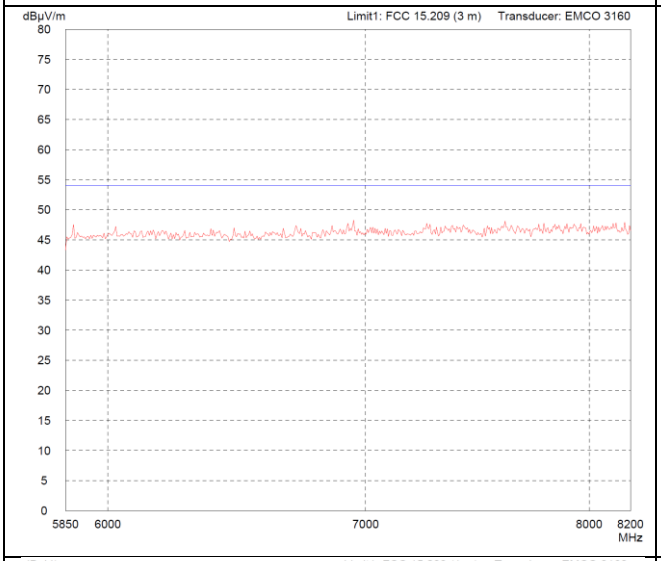
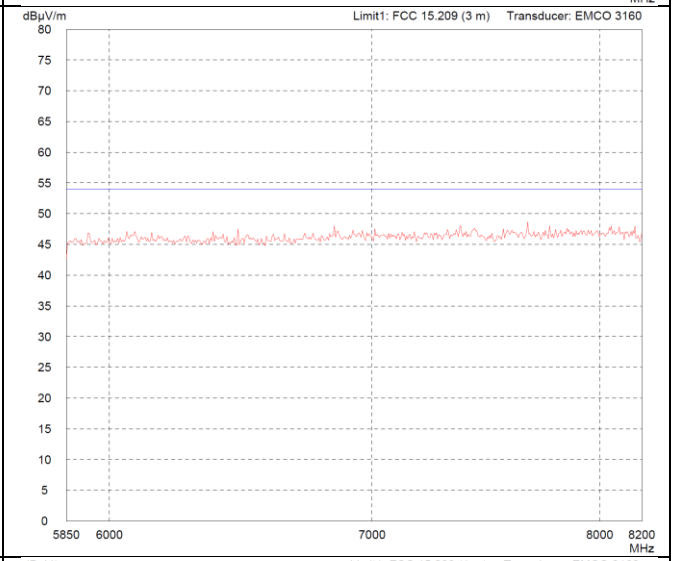
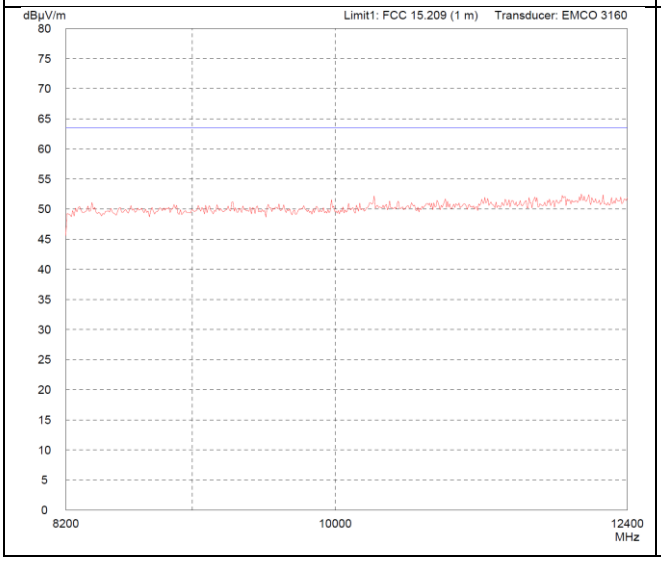
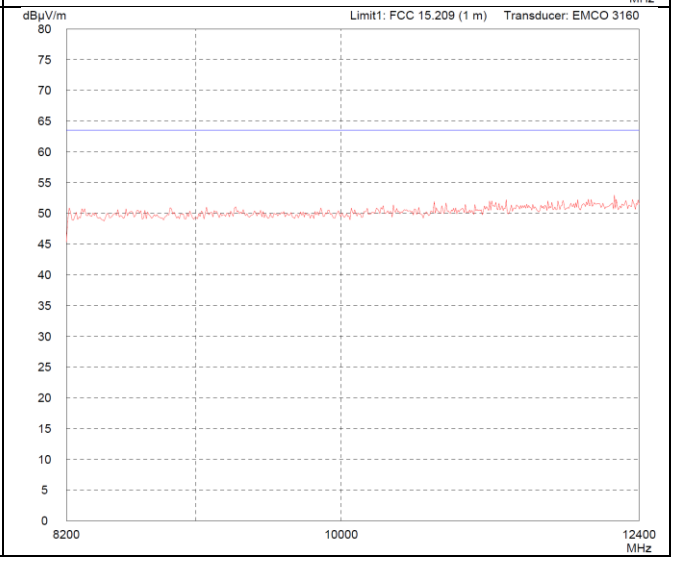
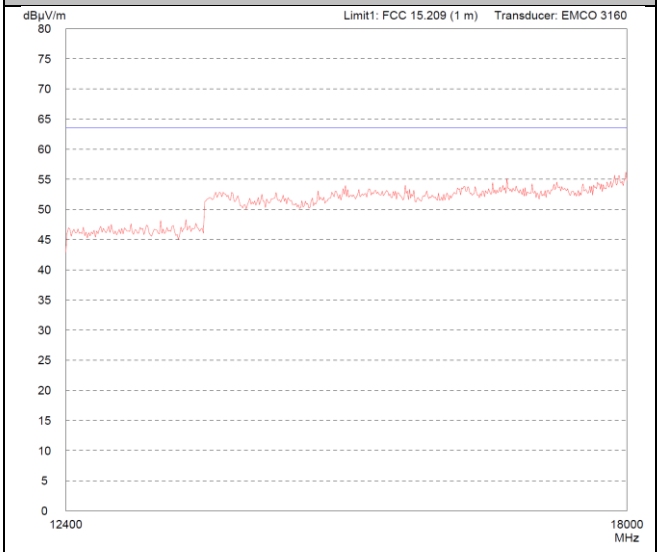
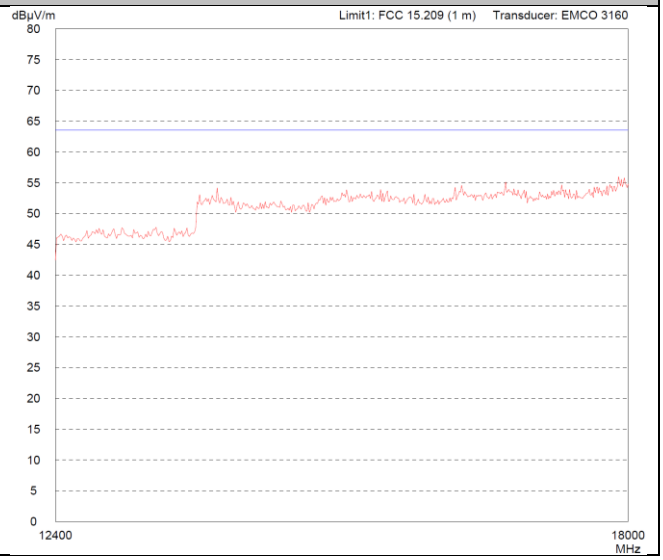
Horizontal Polarisation	Vertical Polarisation
	
	
	

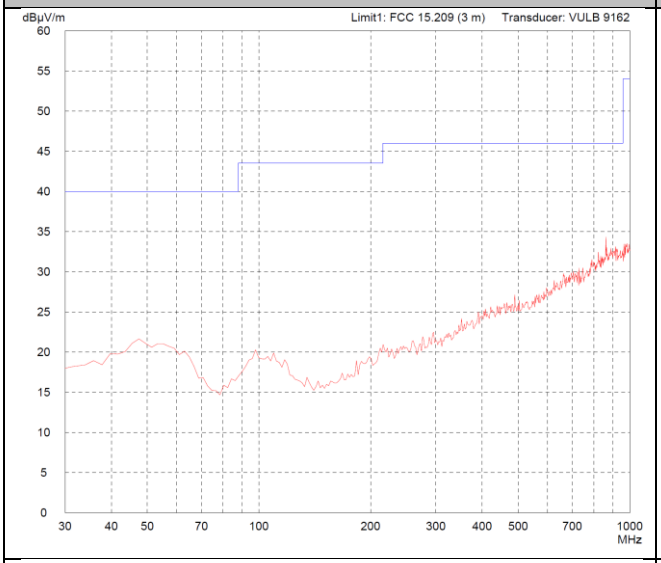
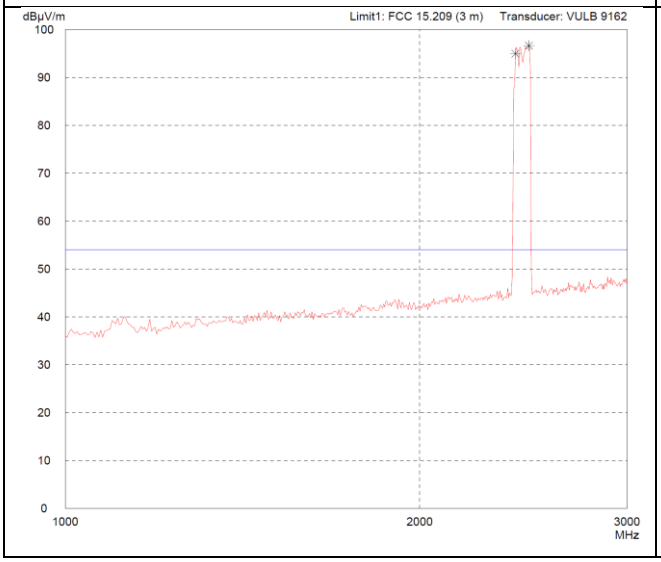
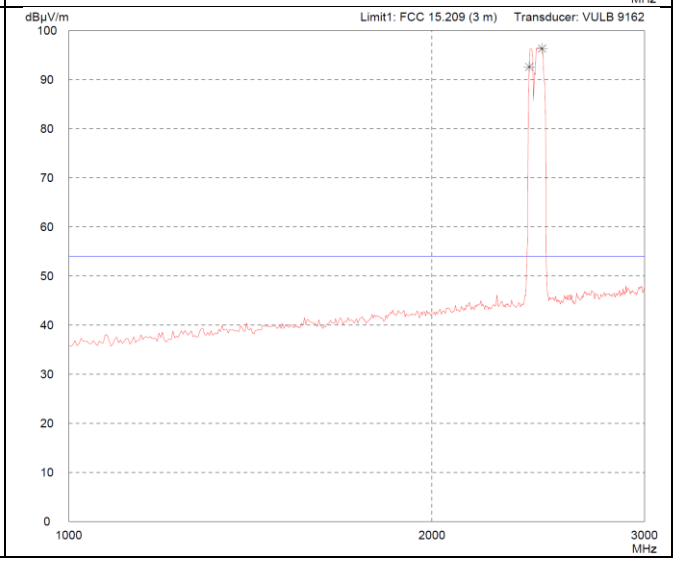
Horizontal Polarisation	Vertical Polarisation
	

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 6 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

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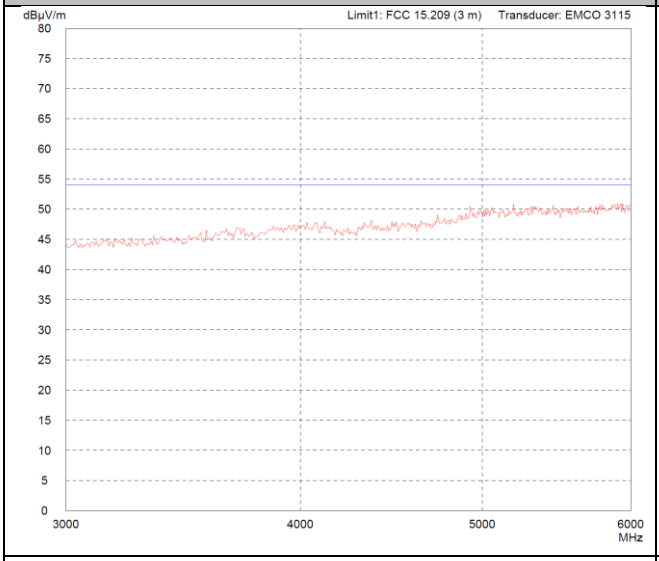
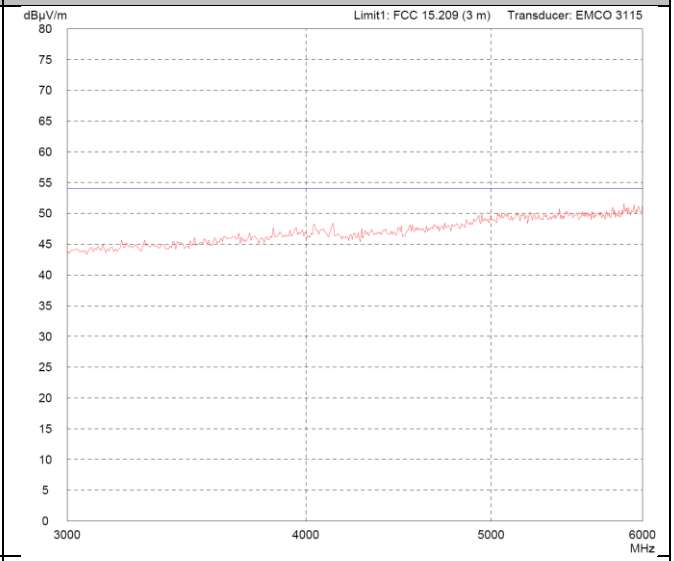
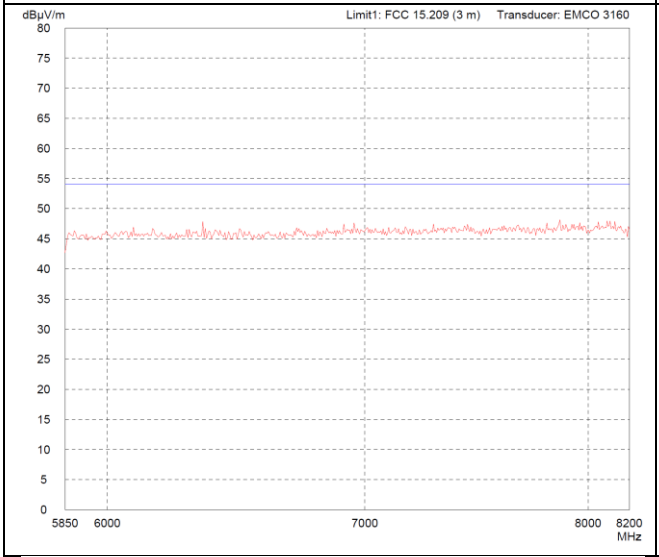
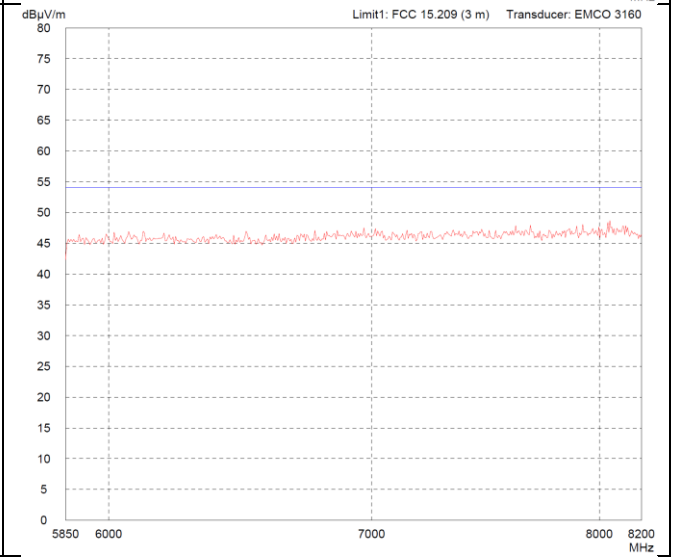
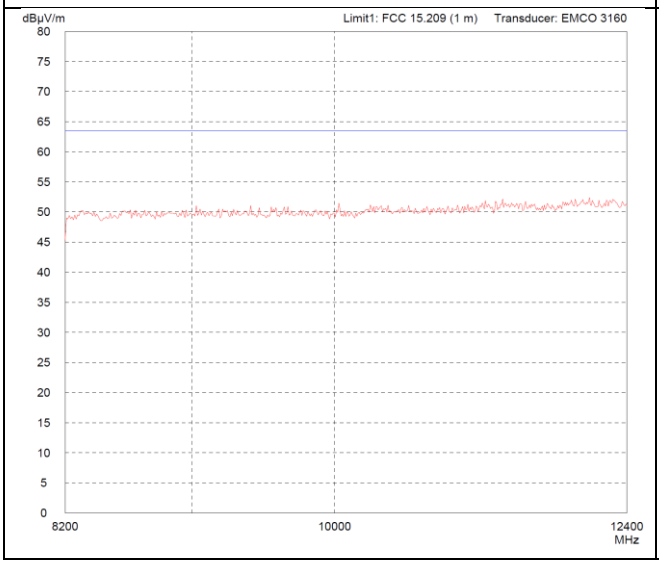
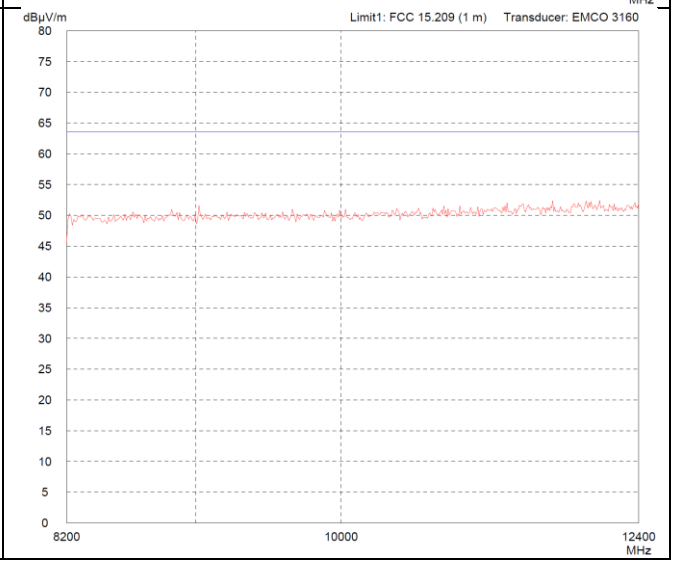
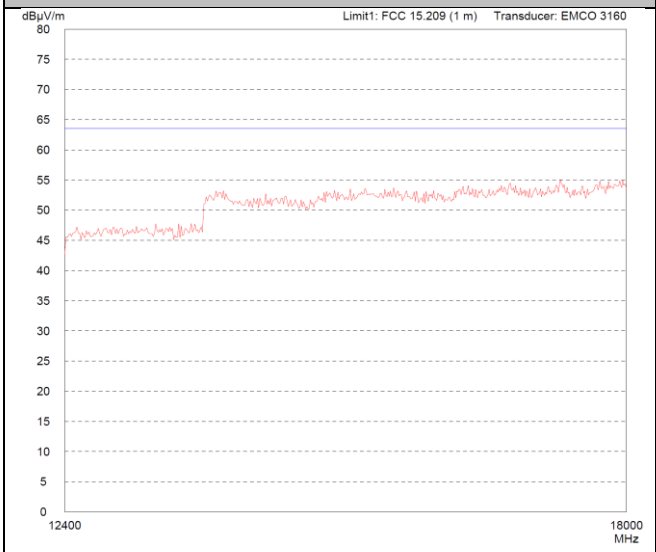
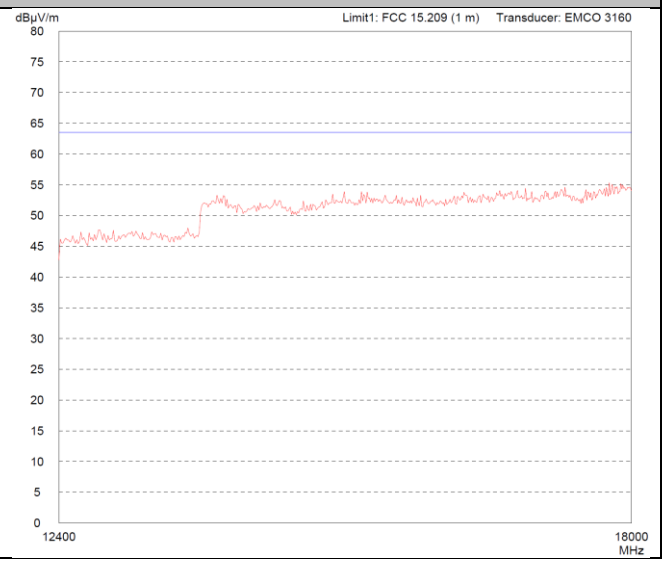
Horizontal Polarisation	Vertical Polarisation
	
	
	

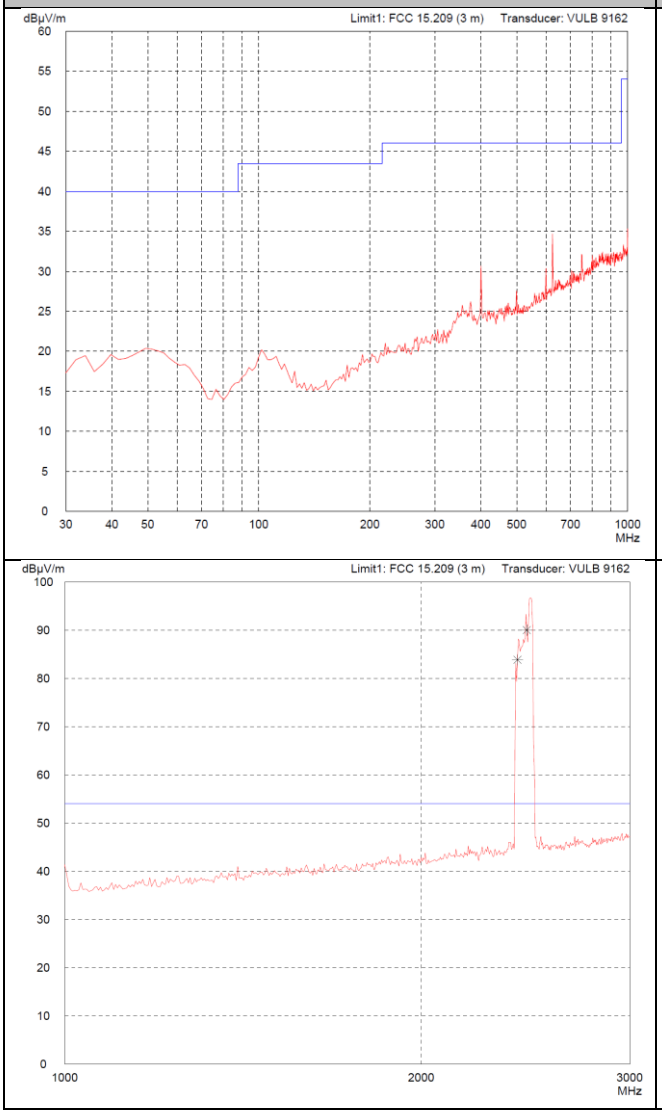
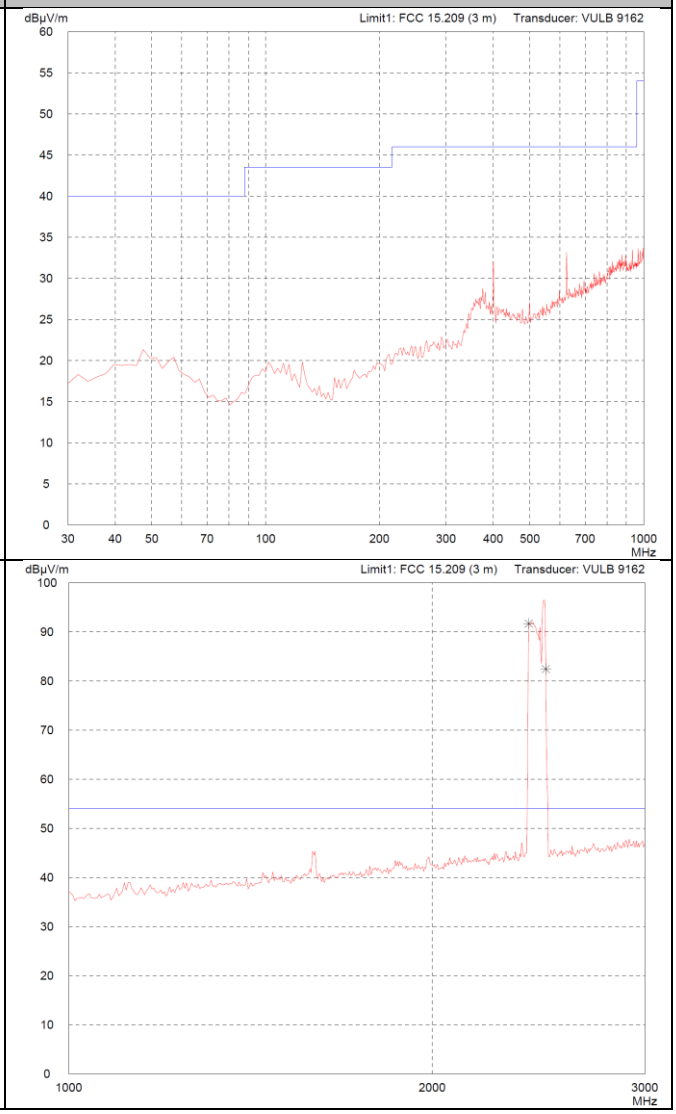
Horizontal Polarisation	Vertical Polarisation
	

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 7 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	

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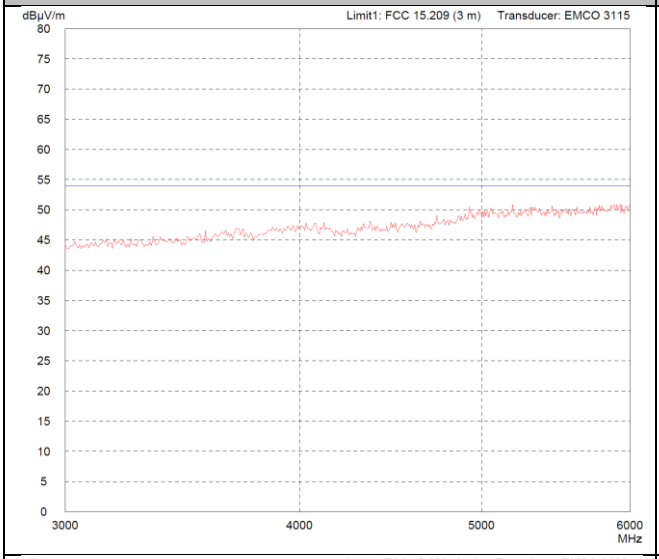
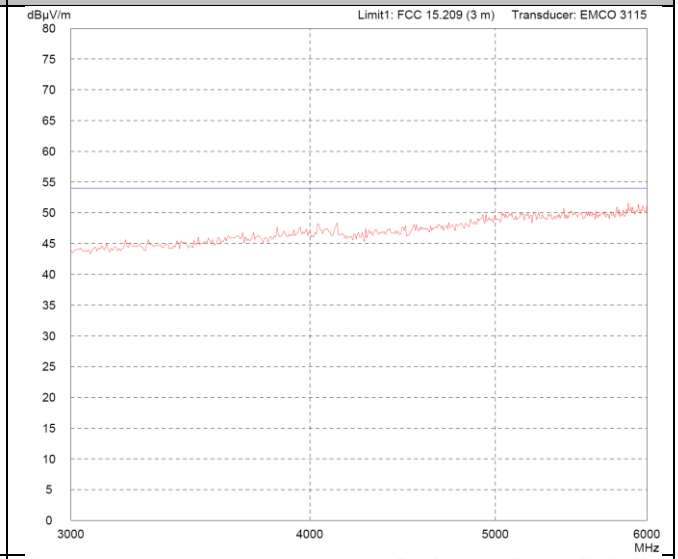
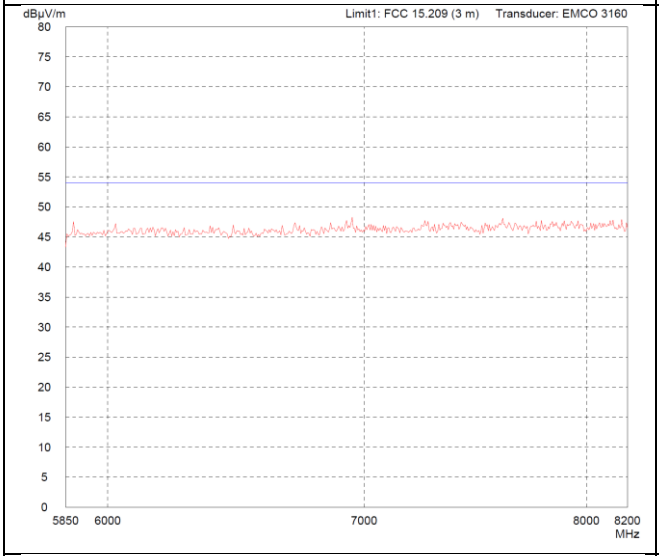
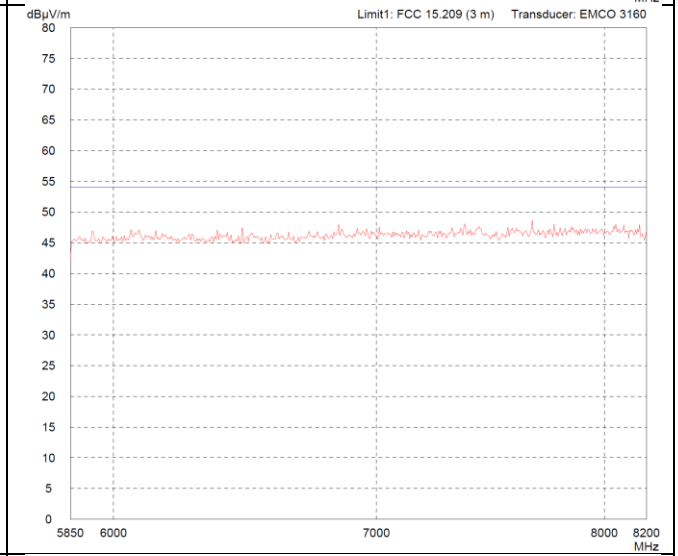
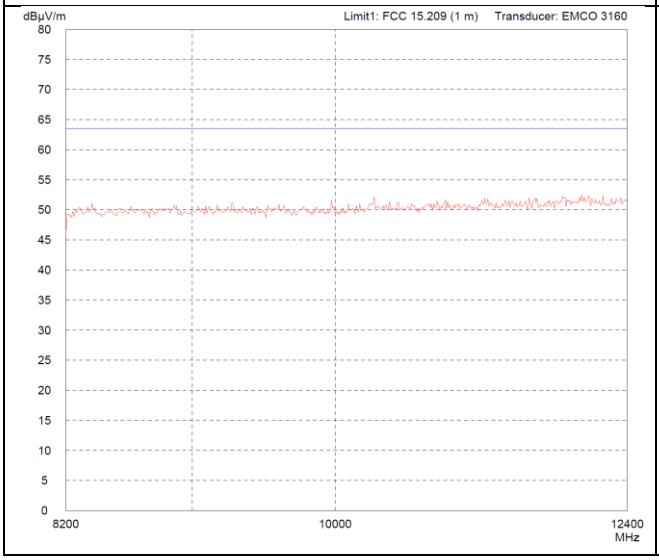
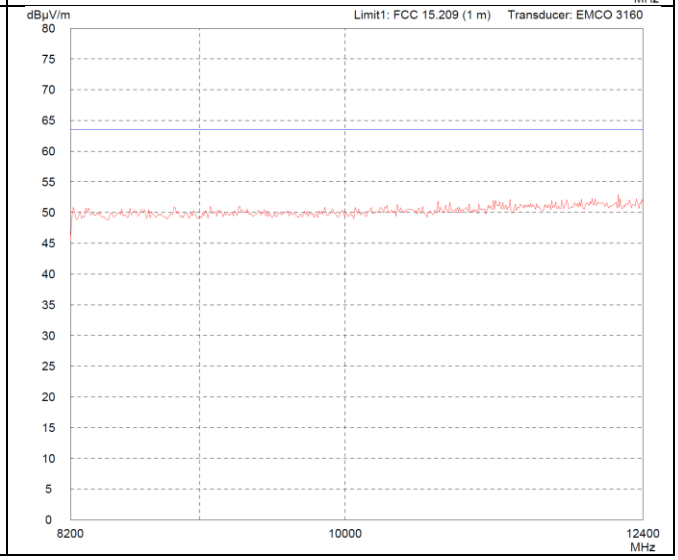
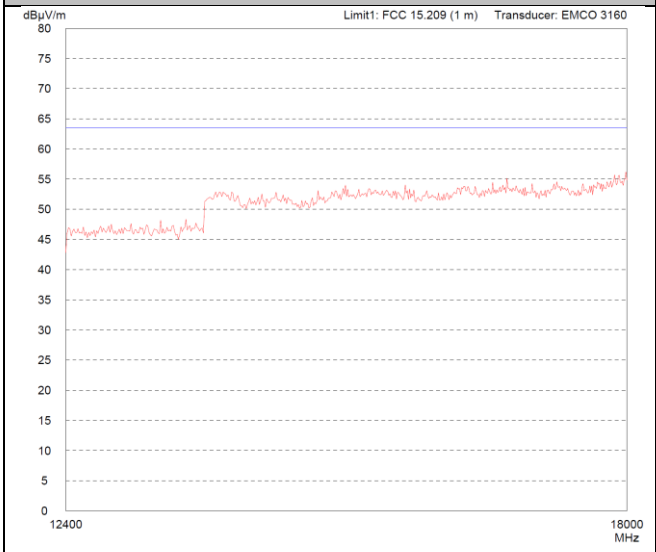
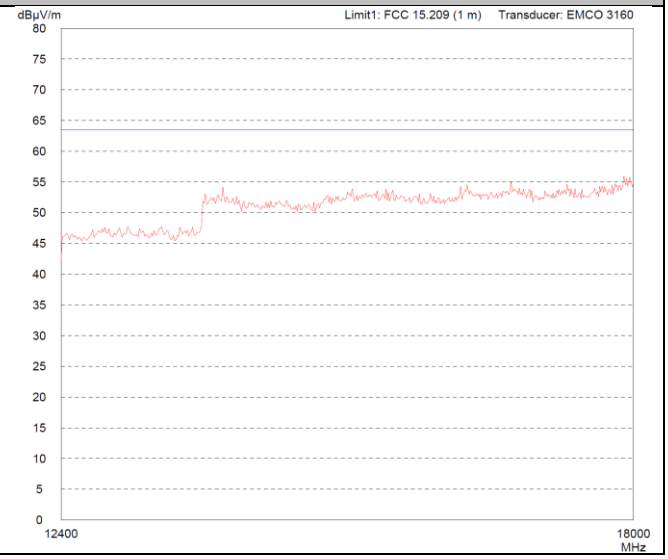
Horizontal Polarisation	Vertical Polarisation
	
	
	

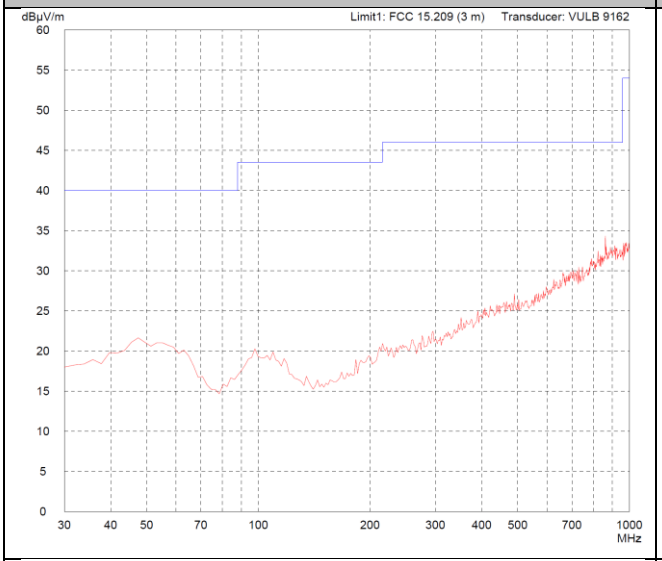
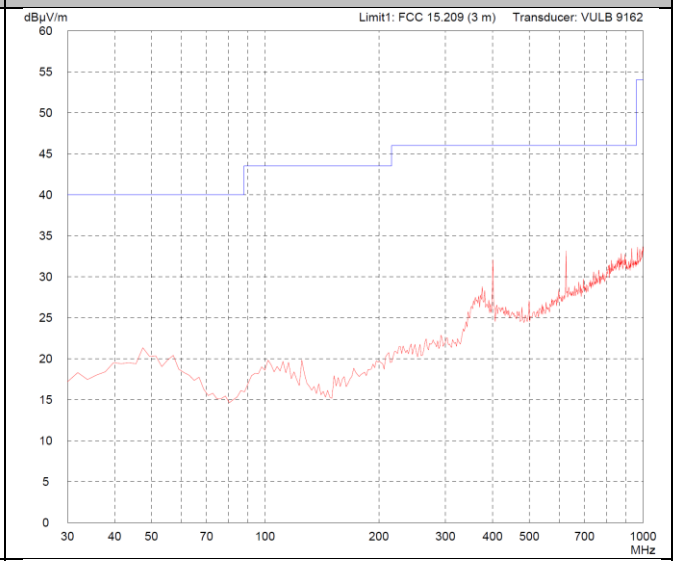
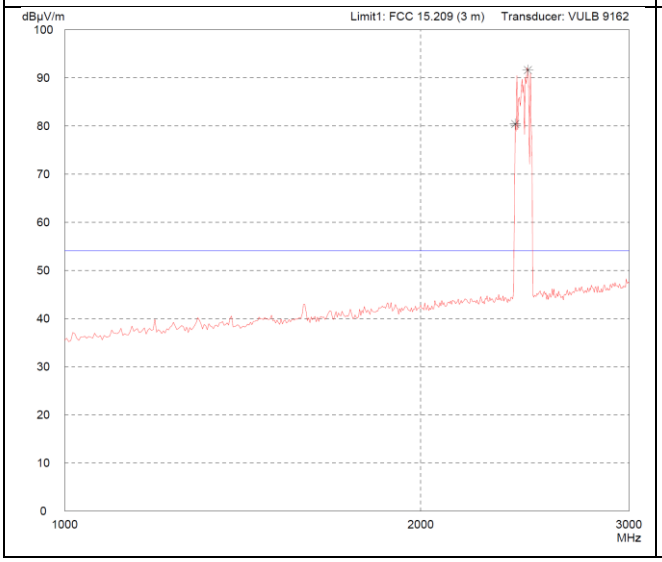
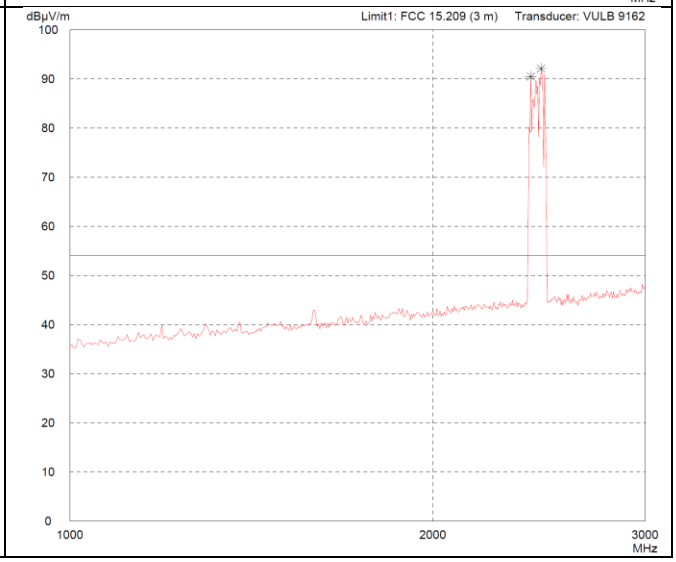
Horizontal Polarisation	Vertical Polarisation
	

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 8 (see section 5)
Date of test:	November 19 to 24, 2014, September 14, 2015
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

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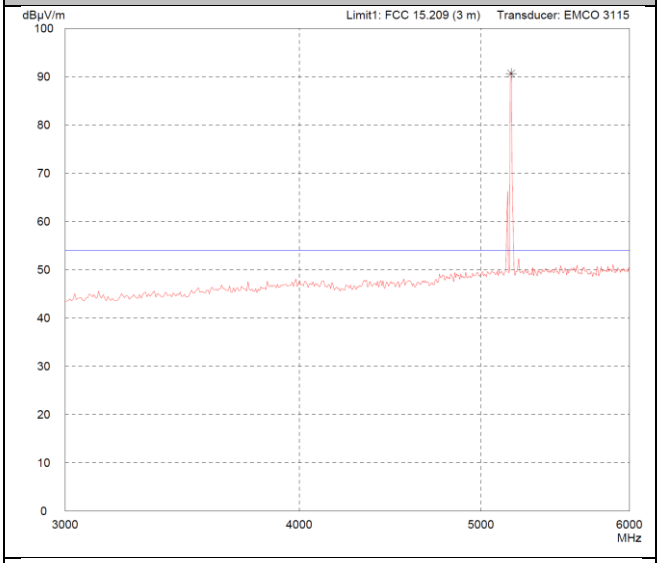
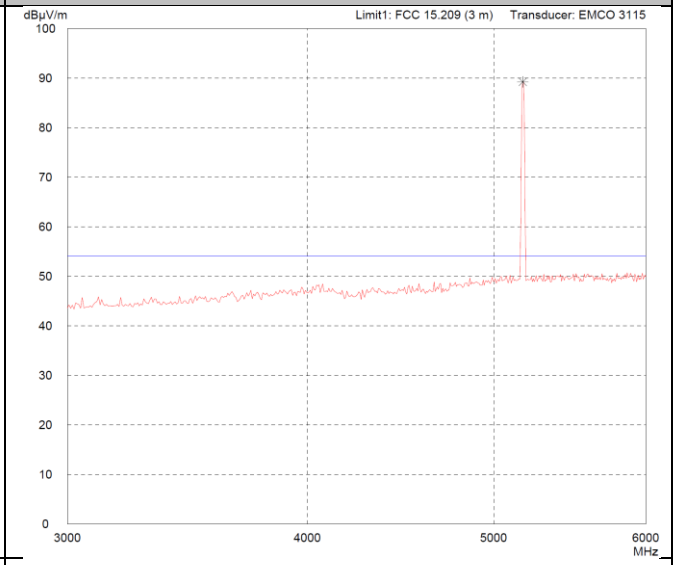
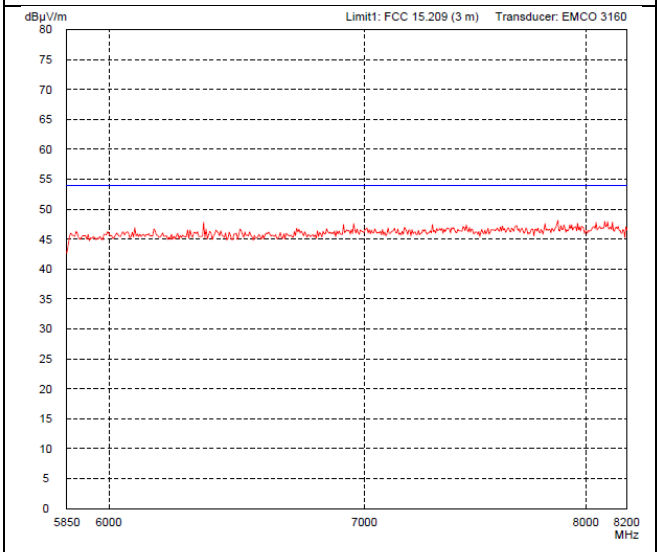
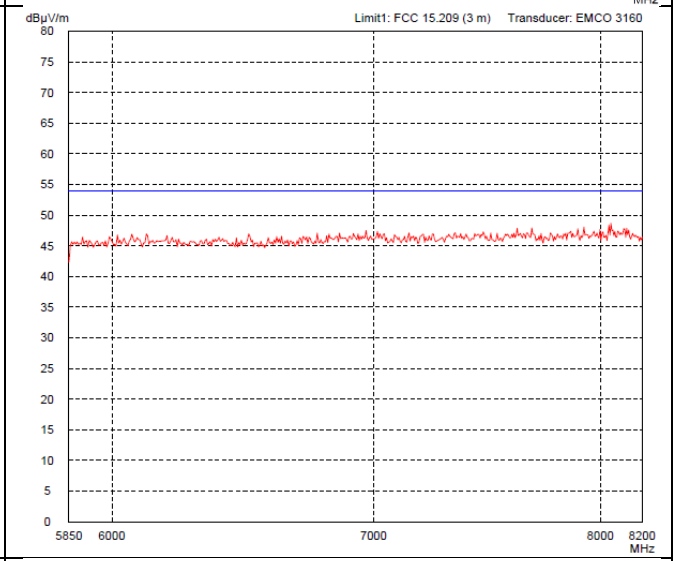
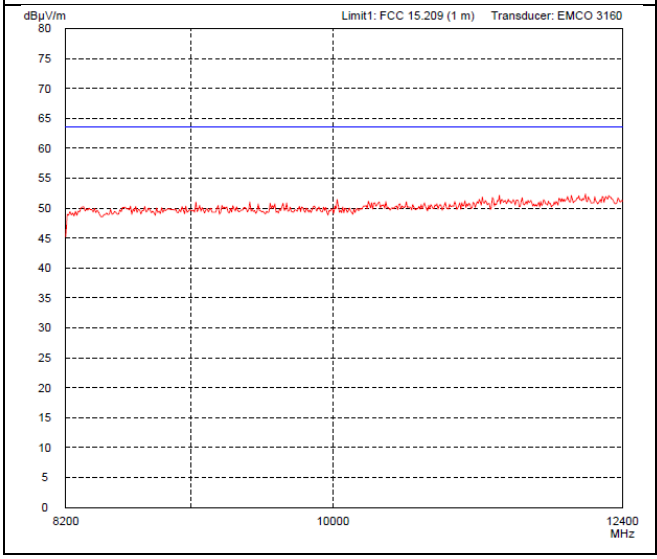
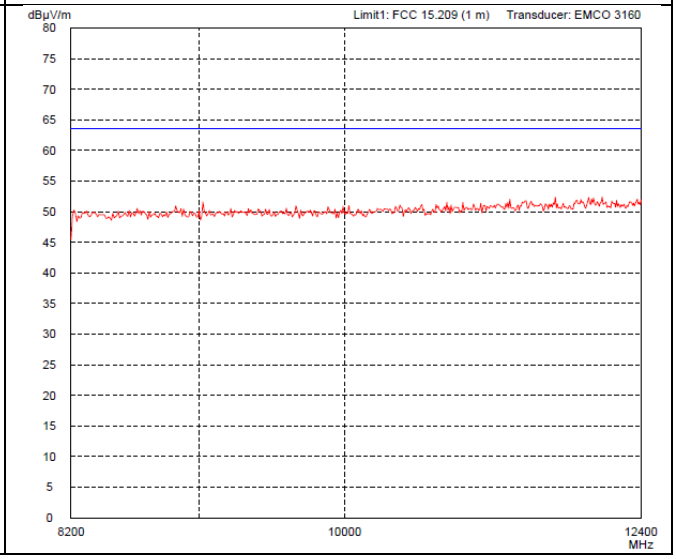
Horizontal Polarisation	Vertical Polarisation
	
	
	

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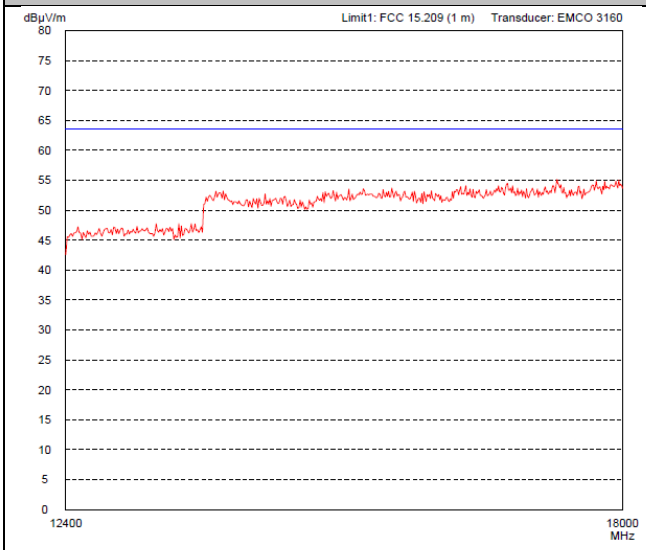
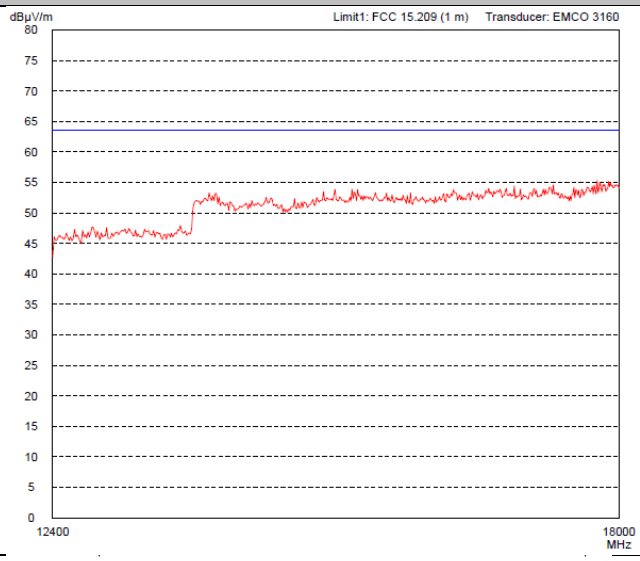
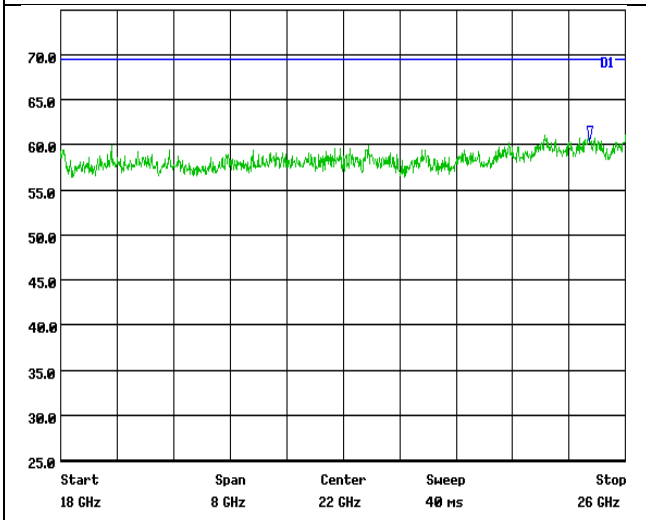
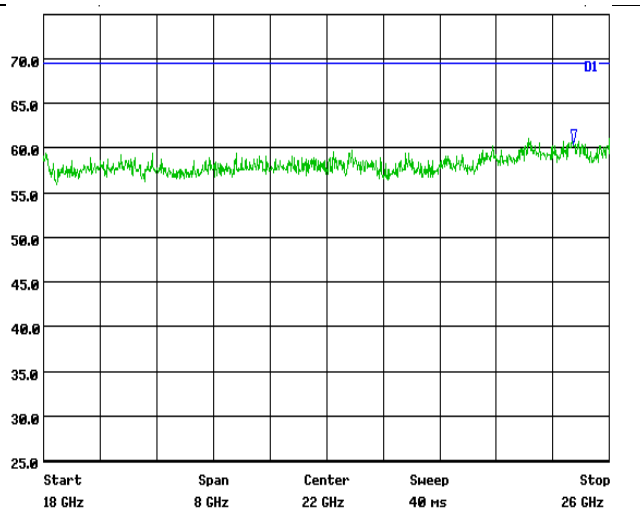
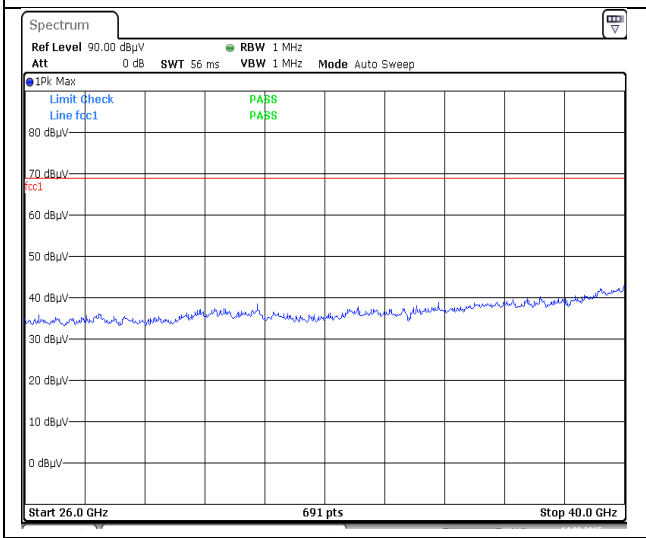
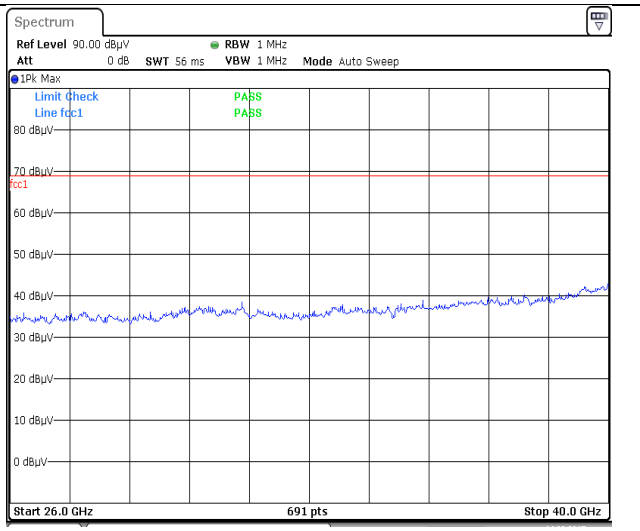
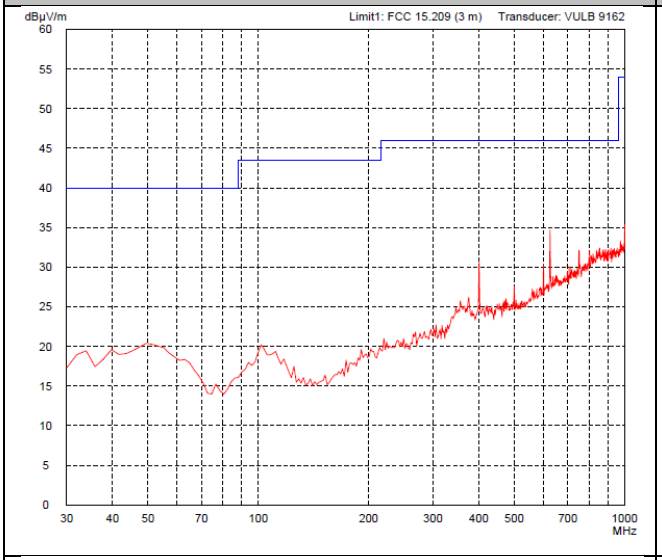
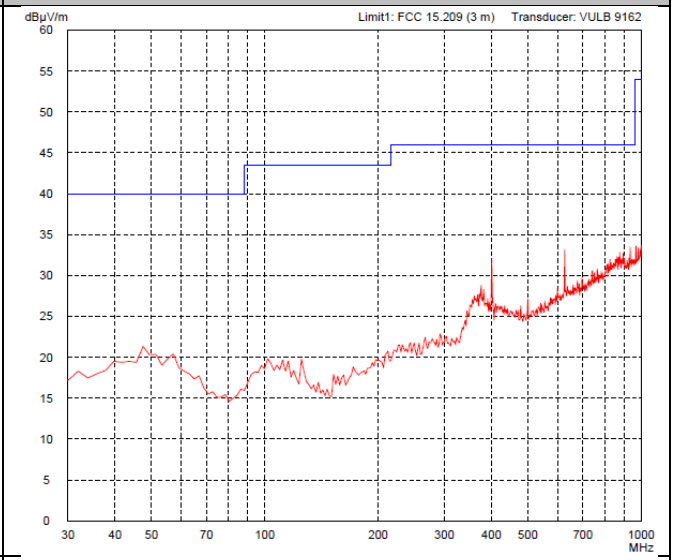
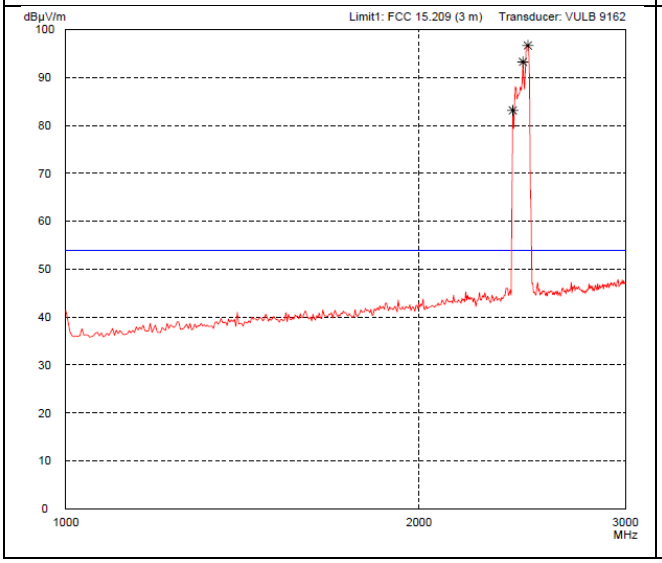
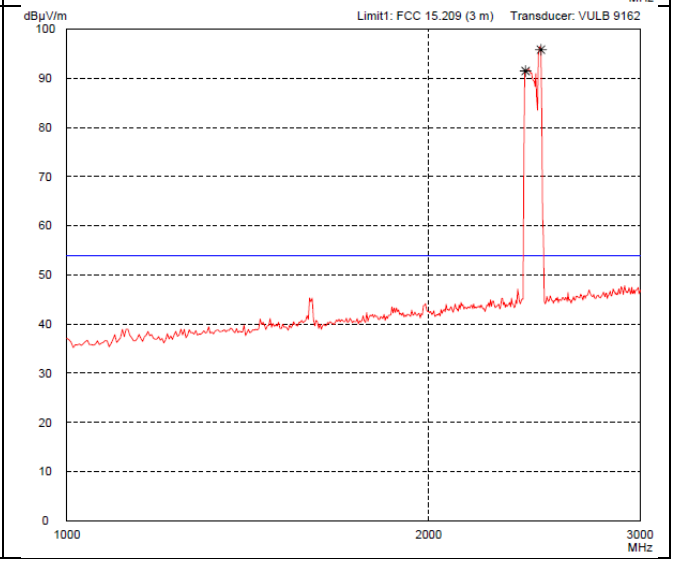
Horizontal Polarisation	Vertical Polarisation
	
	
	

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 9 (see section 5)
Date of test:	November 19 to 24, 2014
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	
	

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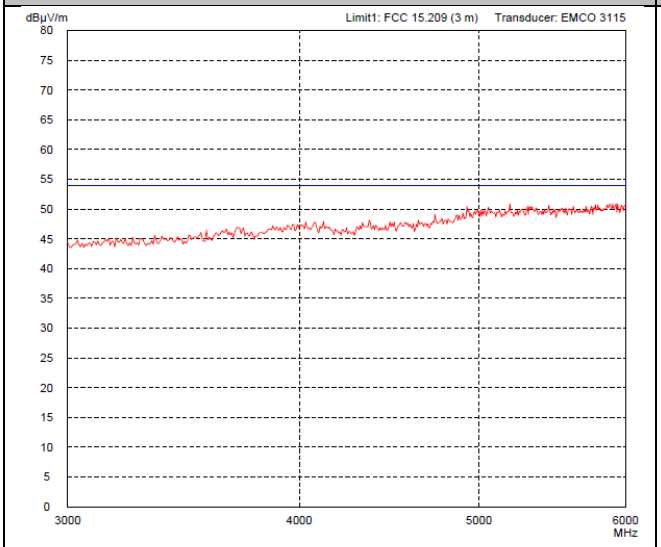
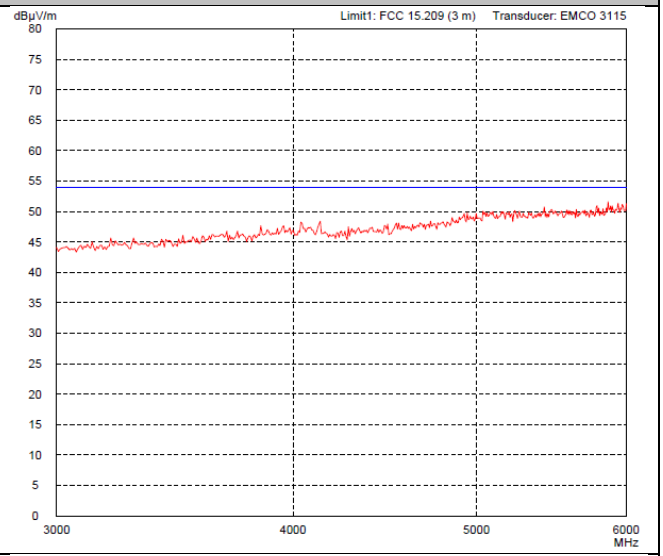
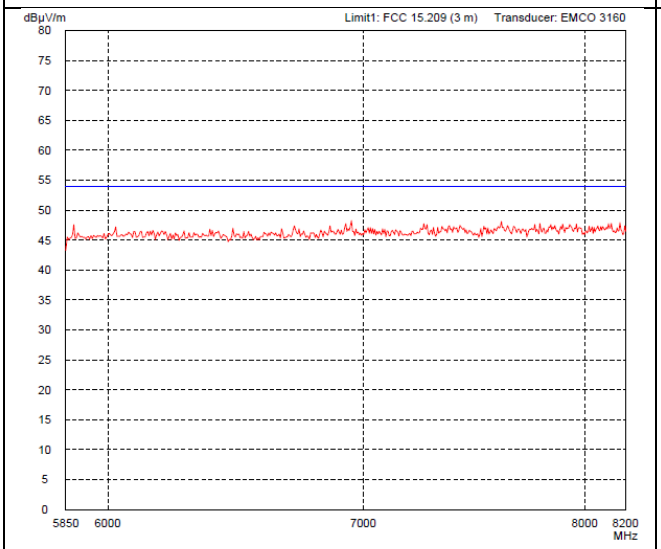
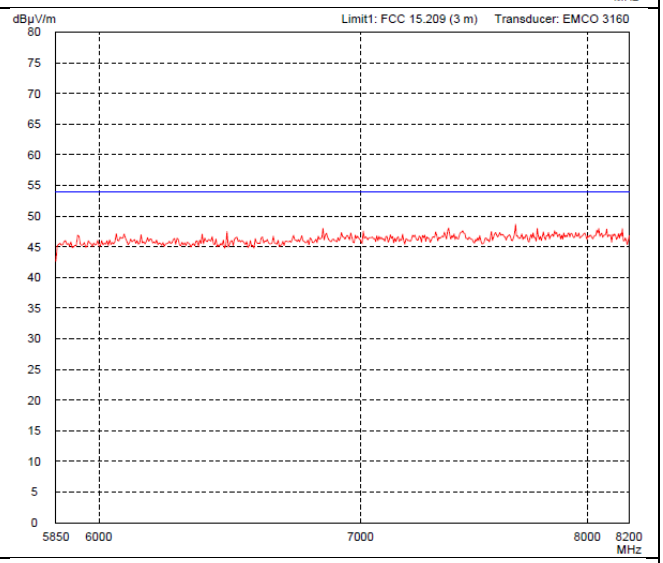
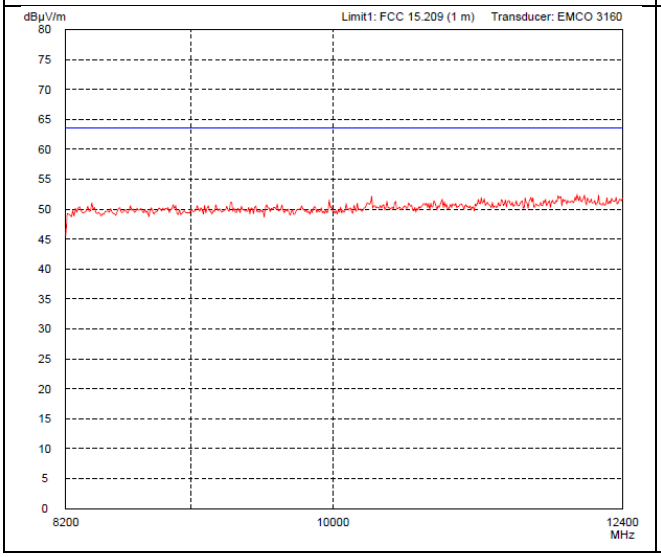
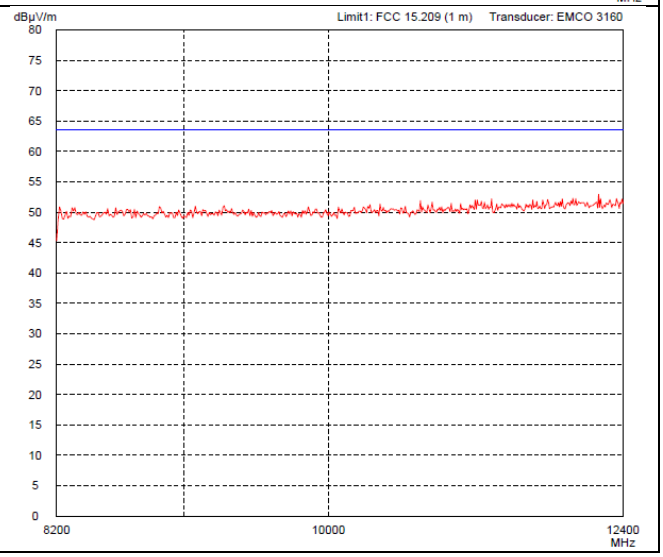
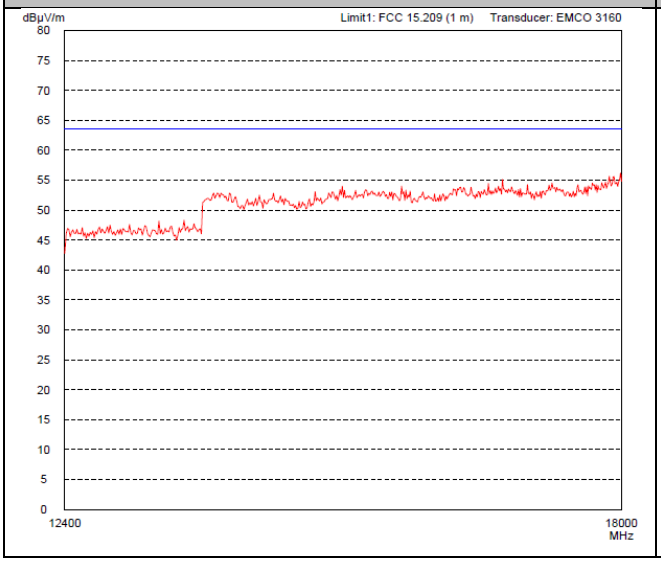
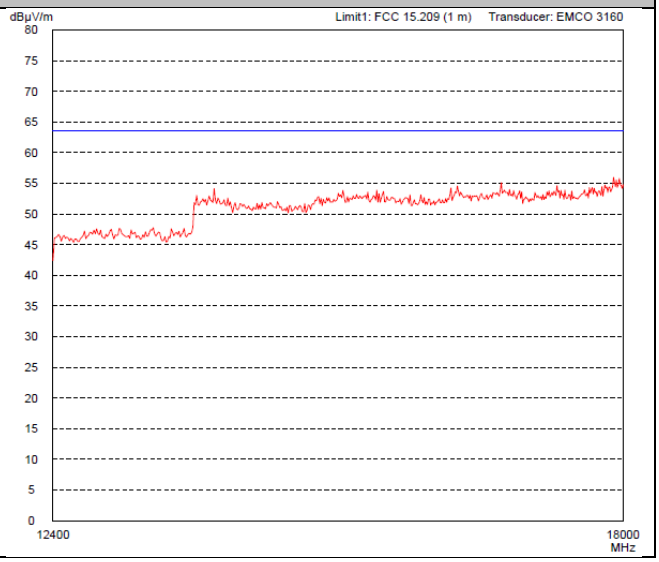
Horizontal Polarisation	Vertical Polarisation
	
	
	

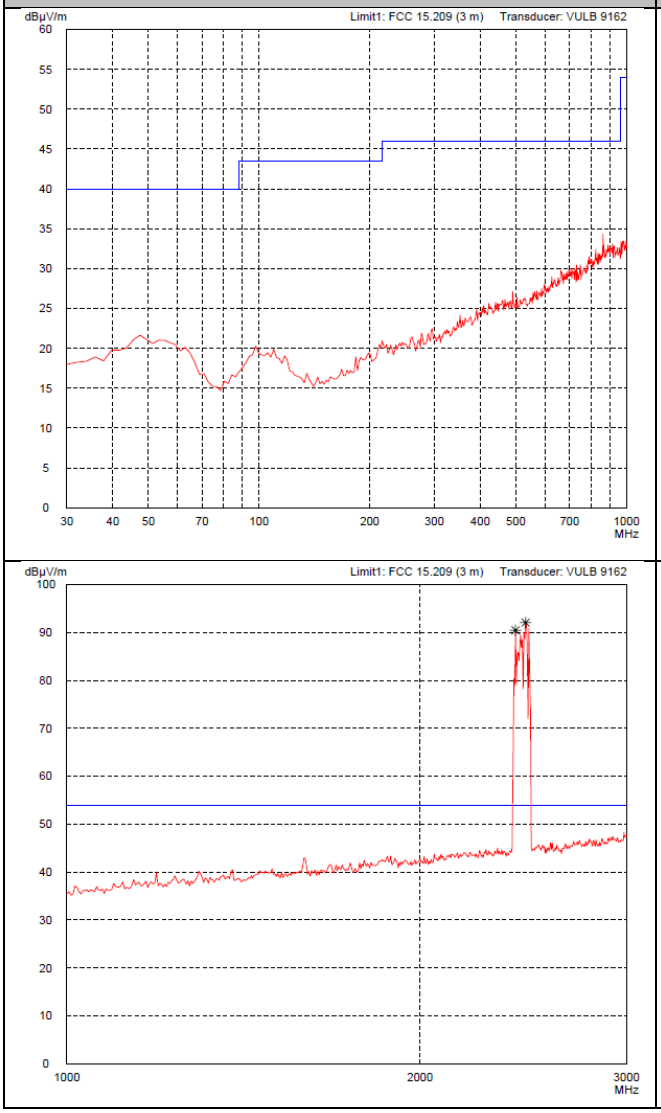
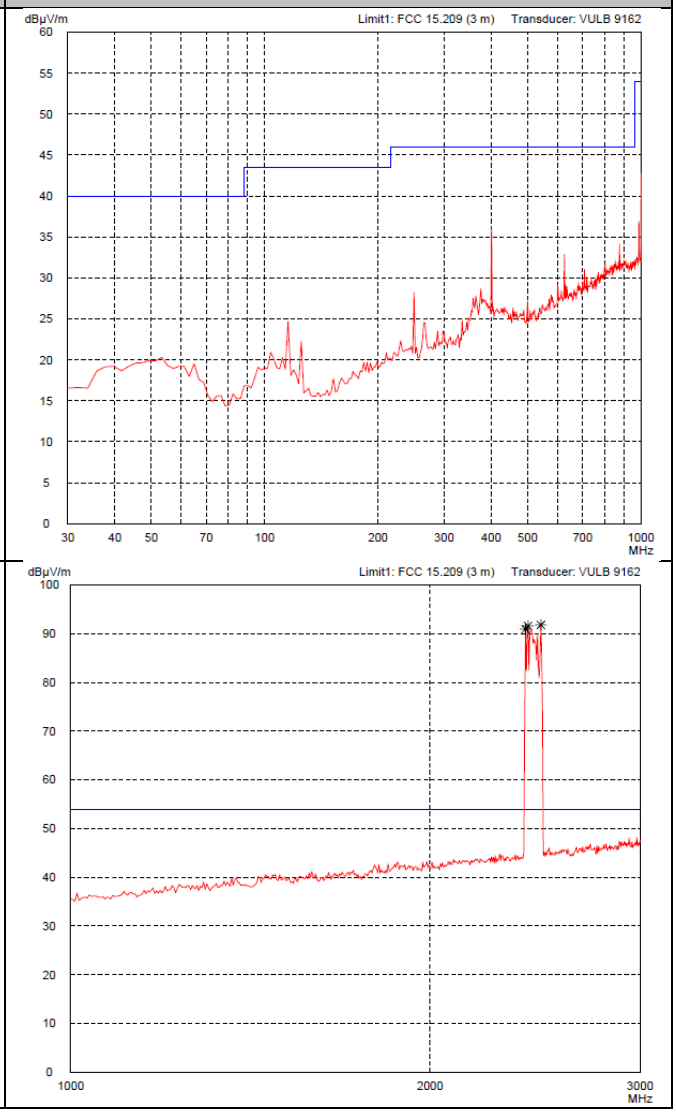
Horizontal Polarisation	Vertical Polarisation
	

Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

Comment:	Test Mode 10 (see section 5)
Date of test:	November 19 to 24, 2014, September 14, 2015
Test site:	Frequencies ≤ 1 GHz: Fully anechoic room, cabin no. 2; Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Horizontal Polarisation	Vertical Polarisation
	

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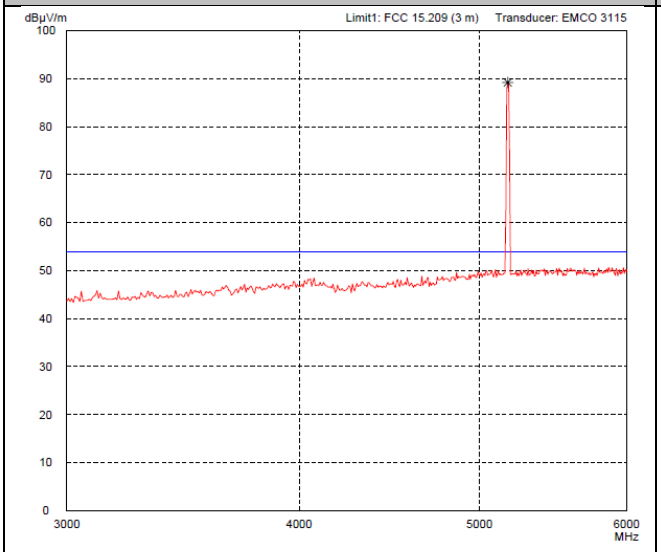
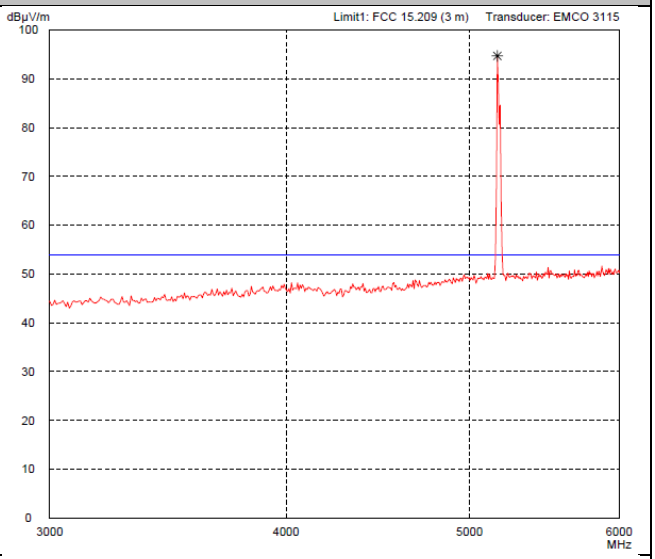
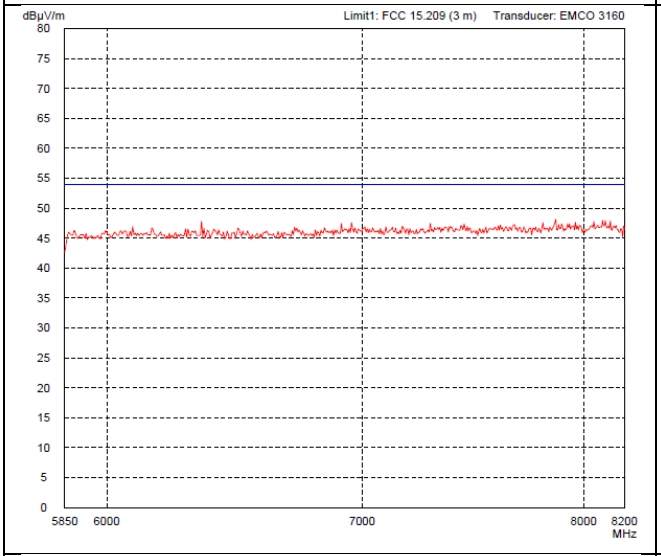
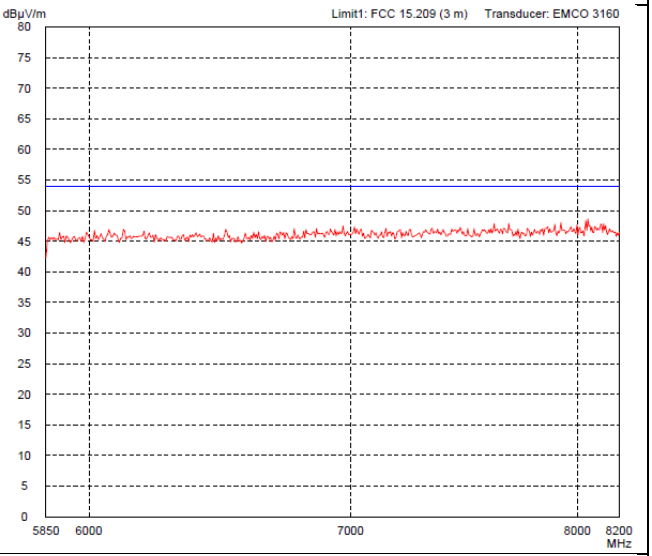
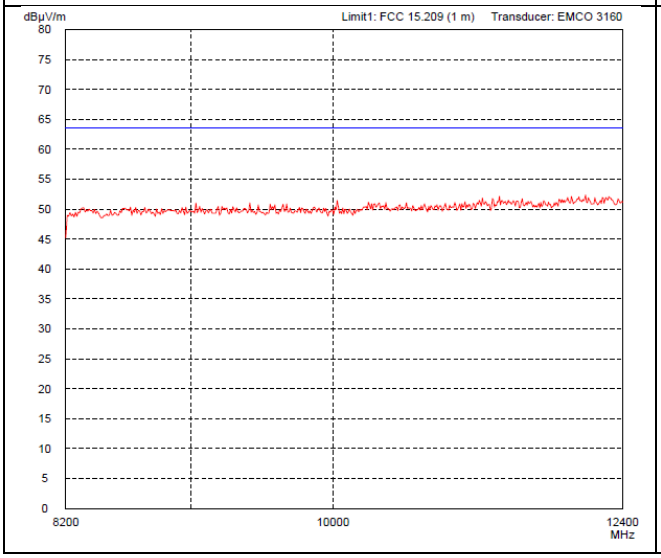
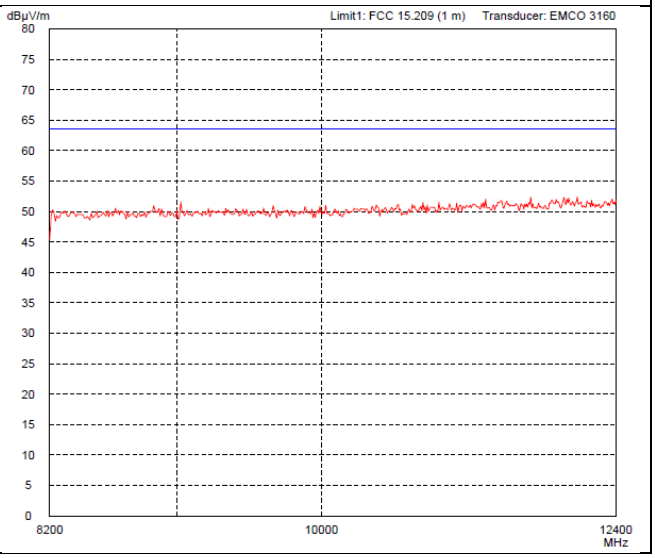
Horizontal Polarisation	Vertical Polarisation
	
	
	

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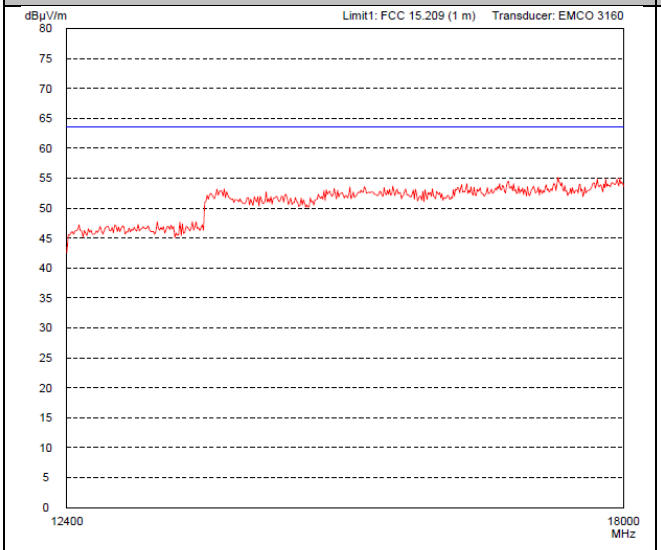
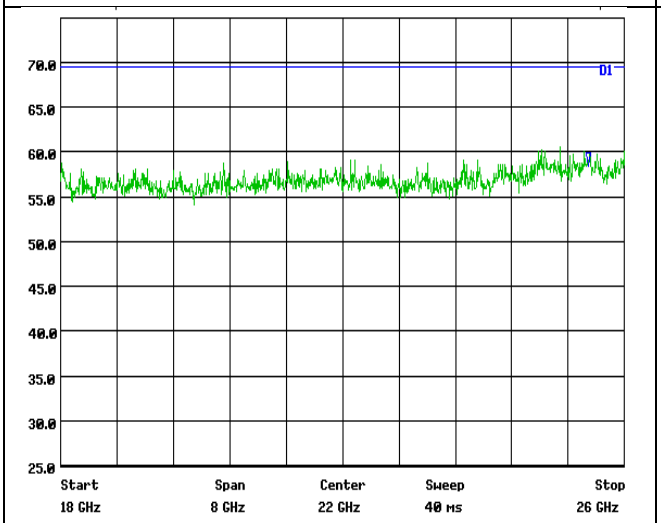
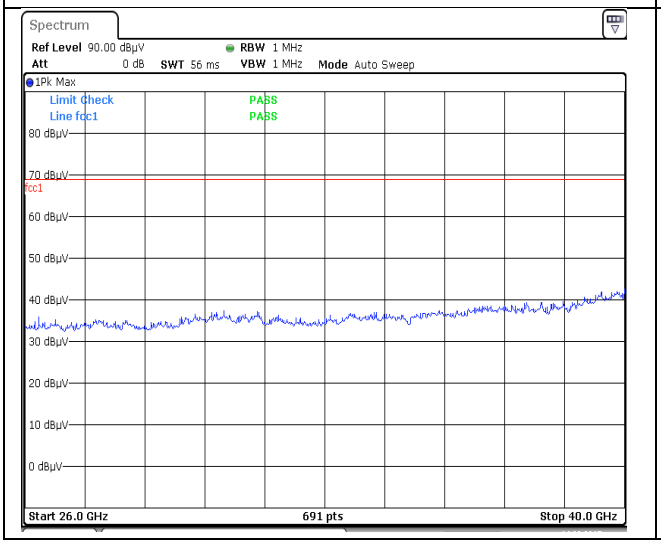
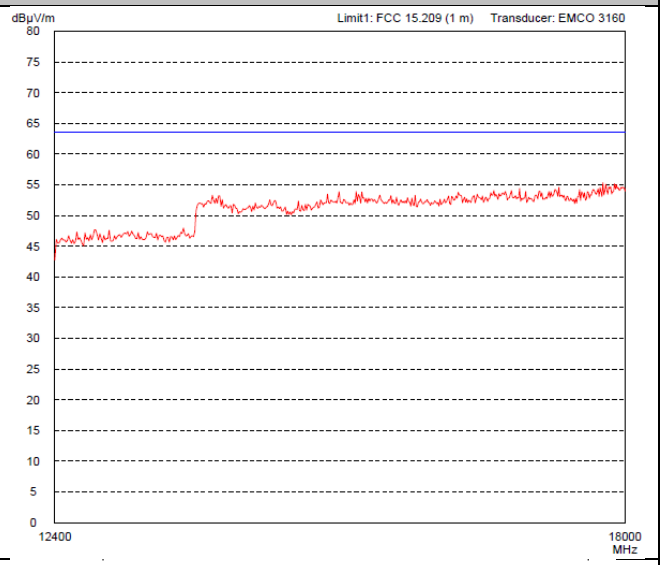
Horizontal Polarisation

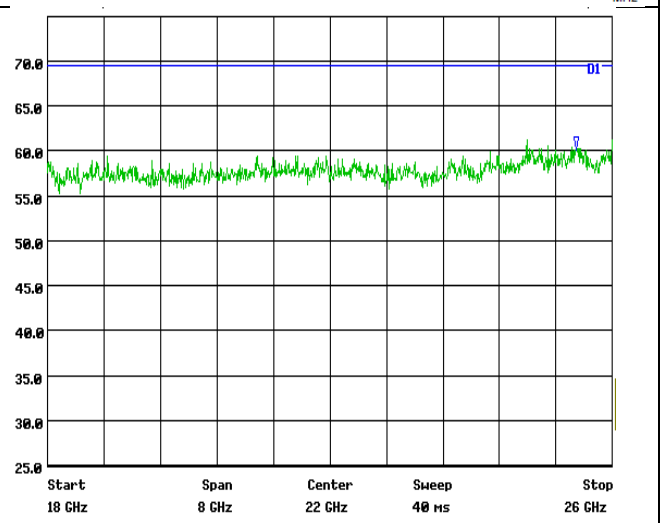


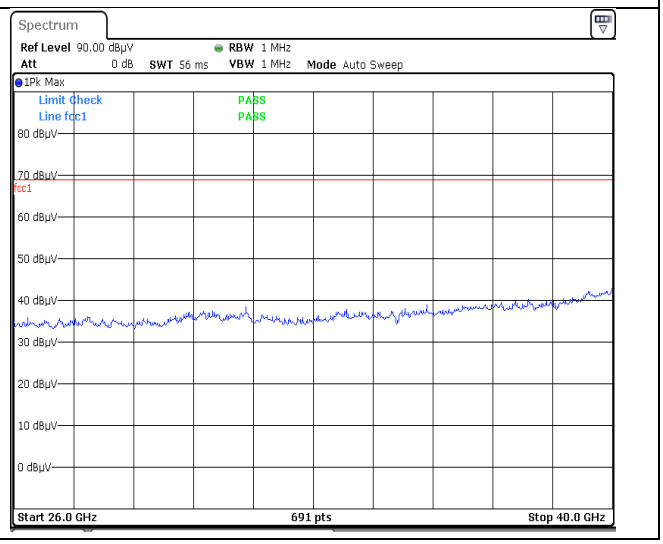




Vertical Polarisation







Sample calculation of final values:

Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 1, 2014
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2014
☒	ANSI C63.4	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	December 11, 2003 (published on January 30, 2004)
☐	ANSI C63.4	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	June 7, 2009 (published on September 15, 2009)
☒	RSS-Gen	Radio Standards Specification RSS-Gen Issue 4 containing General Requirements and Information for the Certification of Radiocommunication Equimpment, published by Industry Canada	November 2014
☒	RSS-210	Radio Standards Specification RSS-210 Issue 8 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	December 2010
☐	RSS-310	Radio Standards Specification RSS-310 Issue 3 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	December 2010
☒	RSS-102	Radio Standards Specification RSS-102 Issue 4: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada	March 2010, footnote 13 updated December 2010
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 7, 2004
☒	CISPR 22	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, “Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement”	1997

☐	CAN/CSA-CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment CAN/CSA CISPR 22-10 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2002
☐	CAN/CSA CISPR 22-10	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2010
☒	TRC-43	Notes Regarding Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service, published by Industry Canada	October, 2008

10 Test Equipment List with Calibration Data

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Last Calibration*	*Next Calibration*
EMI test receiver	1028	ESHS10	860043/016	Rohde & Schwarz	Rohde & Schwarz	09/2014	09/2015
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	02/2014	02/2015
Spectrum analyser	1666	FSP30	100063	Rohde & Schwarz	Rohde & Schwarz	05/2014	11/2015
Spectrum analyser	2364	FSV 40	101448	Rohde & Schwarz	Rohde & Schwarz	09/2015	09/2017
V-network	1060	ESH3-Z5	862770/021	Rohde & Schwarz	Rohde & Schwarz	06/2014	06/2015
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	05/2014	05/2015
TRILOG Broadband Antenna	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	06/2014	06/2016
TRILOG Broadband Antenna (FAC)	2256	VULB 9162	9162-048	Schwarzbeck	Rohde & Schwarz	09/2013	09/2015
Preamplifier	1484	ACO/180-3530	32641	CTT	TÜV SÜD PS-EMC-STR	06/2013	06/2015
Preamplifier	1651	CPA9231A	3393	Schaffner Electrotest	TÜV SÜD PS-EMC-STR	09/2014	09/2015
Preamplifier	1684	AFS3-00100800-32-LN	847743	MITEQ	TÜV SÜD PS-EMC-STR	04/2015	04/2017
Preamplifier	1685	AMF-4D-005080-25-13P	860149	MITEQ	TÜV SÜD PS-EMC-STR	08/2013	11/2015
Preamplifier	1716	CPA9231A	3557	Schaffner EMC Systems	TÜV SÜD PS-EMC-STR	01/2014	01/2016
Double ridged horn antenna	2073	HF907	100154	Rohde & Schwarz	Rohde & Schwarz	05/2013	05/2015
Double ridged waveguide horn antenna	1516	3115	9508-4553	EMCO Elektronik	Seibersdorf Laboratories	11/2012	11/2014
Horn antenna	1576	WM782A, FS-Z40	845881/005	Tektronix	Rohde & Schwarz	01/2013	01/2016
Horn antenna	1010	3160-03	9112 -1003	EMCO Elektronik		see note 1	
Horn antenna	1011	3160-04	9112-1001	EMCO Elektronik		see note 1	
Horn antenna	1012	3160-05	9112-1001	EMCO Elektronik		see note 1	

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Last Calibration*	*Next Calibration*
Horn antenna	1013	3160-06	9112-1001	EMCO Elektronik		see note 1	
Horn antenna	1014	3160-07	9112-1008	EMCO Elektronik		see note 1	
Horn antenna	1015	3160-08	9112-1002	EMCO Elektronik		see note 1	
Horn antenna	1265	3160-09	9403-1025 (931941-010)	EMCO Elektronik		see note 1	
Horn antenna	1575	3160-10	399185	EMCO Elektronik		see note 1	
Horn antenna	2086	24240-20	157845	Flann		see note 1	
Horn antenna	2180	25240-25	205900	Flann		see note 1	
Horn antenna	2182	27240-25	204260	Flann		see note 1	

Note 1: No calibration required.
Note 2: Not calibrated separately but with the whole test system when recording calibration data.
Note 3: No calibration required. Devices are checked before use.
Note 4: No calibration required. Devices are checked by calibrated equipment during test.

11 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	November 25, 2014	M. Biberger	First Edition
2	February 27, 2015	M. Biberger(as)	Second Edition: General data of EUT added, FCC ID added, page 10: comment BT connection changed, Test Equipment List ESU 8 changed, RSS-GEN Issue 3 changed to Issue 4 and RSS-GEN Issue 4 references updated, 8.4 SAR evaluation added
3	September 14, 2015	M. Biberger(as)	Third Edition: Emission measurement in operating mode 2/4/8/10 extended to 40 GHz. Test equipment list completed, 8.4 SAR evaluation removed
4	September 18, 2015	M. Biberger(as)	Fourth Edition: Page 3: FCC ID from host corrected, September 22, 2015, types corrected