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RADIO TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)

Test Sample: 900 MHz Band Frequency Hopping Radio
Model: SI902M160

Report Number: M160245-1Rev1
(Replaces Report M160245-1)
FCC ID: UIPSI902M160
Tested for: 4RF Ltd

Issue Date: 9 August 2016

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

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Report Number: M160245-1Rev1
Issue Date: 09 August 2016

Test Sample: 900 MHz Band Frequency Hopping Radio
Model: SI902M160

Equipment Type: Intentional Radiator (Transceiver)

Manufacturer: 4RF Ltd
Address: 26 Glover Street, Ngauranga,
Wellington, NEW ZEALAND
Phone: +64 (0)4 499 6000
Contact: Mr Paul Young
Email: paul.young@4rf.com

Test Standards: **FCC Part 15** – Radio Frequency Devices

         FCC Part 15 Subpart C – Intentional Radiators

         Section 15.247 – Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

Test Date: 12th, 13th and 30th April and 21st May 2016

Test Engineer:

Mahan Ghassempouri   Larry Phuah
Test Engineer   Test Engineer
M.Sc. in Telecommunication

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

Authorised Signatory: Chris Zombolas
Technical Director
EMC TECHNOLOGIES PTY LTD

RADIO TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)

1.0   INTRODUCTION

Radio testing was performed on the 900 MHz band frequency hopping radio, Model Number SI902M160

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

47 CFR, Part 15, Subpart C: Rules for intentional radiators (particularly section 15.247)
Section 15.203:   Antenna requirements
Section 15.205:   Restricted bands of operation
Section 15.207:   Conducted Emission Limits
Section 15.209:   Radiated Emission Limits (General requirements)
Section 15.247:   Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The measurement procedure applied was in accordance with ANSI C63.10: 2013. The instrumentation conformed to the requirements of ANSI C63.2: 2009.

1.1   Summary of Results

FCC Part 15 Subpart C	Test Performed	Results
15.203	Antenna requirement	Complied
15.205	Operation in restricted Band	Complied
15.207	Conducted emissions limits	Compied
15.209	Radiated emissions limits	Complied
15.247 (a)(1)	Hopping channel separation	Complied
15.247 (a)(1)(i)	20 dB bandwidth Number of hopping frequencies Dwell time	Complied
15.247 (a)(2)	Minimum 6 dB Bandwidth	N/A as the EUT employed FH
15.247 (b)(2)	Peak Output Power	Complied
15.247 (c)	Antenna Gain > 6 dBi	N/A as EUT was supplied with an antenna of less than 6 dBi gain.
15.247 (d)	Out of Band Emissions	Complied
15.247 (e)	Peak Power Spectral Density	N/A as the EUT employed FH
15.247 (f)	Hybrid Systems	N/A assessed to FH requirements
15.247 (g)	Hopping channel application	Complied
15.247 (h)	Incorporation of intelligence within FHSS	Complied
15.247 (i)	Radio Frequency Hazard	Complied

N/A: Not Applicable
FH: Frequency hopping

1.2   Modifications by EMC Technologies

No modifications were required to achieve compliance.

2.0 GENERAL INFORMATION
(Information supplied by the Client)

2.1 EUT (Transmitter) Details

The 900 MHz Band Frequency Hopping Radio was a Point-To-Multipoint (PMP) digital radio providing 915 MHz Industrial Licence Free Spread Spectrum communications. The radios carried a combination of serial data and Ethernet data between the base station and remote stations. A single unit was configurable as a Point-To-Multipoint base station or remote station. Transmitter specifications are shown in below table.

DC Supply Port Voltage Rating:	12 to 24 VDC
Operating Frequency Range:	902.5 MHz to 927.5 MHz
Low:	902.5 MHz
Middle:	915.0 MHz
High:	927.5 MHz
Nominal <u>Peak</u> Conducted Power:	30 dBm
Number of Channels:	50 to 400, set in blocks of 50
20 dB Bandwidth:	50 kHz
Modulation and power settings:	64QAM: +7 dBm to +23 dBm
	16QAM: +8 dBm to +24 dBm
	QPSK: +10 dBm to +26 dBm
Antenna supplied for testing:	Monopole (2.5 dBi, Note 1)
	Ventev M4025025R10005 Antenna
Operating Temperature Range:	-40 °C to 70 °C

Note 1: The following table and an accompanying explanation were given in the product manual regarding different types of antenna which could be used and how to calculate the maximum permissible gain for each.

Antenna Type and Gain	Feeder Coax Length and Loss	Regulatory Limit	Maximum SRi Power Setting
Yagi, 11 dBi	10 m of ½" Heliax @ 0.11 dB/m gives 1.1 dB loss	+36 dBm PEP	22 dBm
Panel, 12 dBi	33 m of RG214 @ 0.22 dB/m gives 7.3 dB loss	+30 dBm	25 dBm
Dipole, 3.5 dBi	3 m of RG214 @ 0.22 dB/m gives 0.66 dB loss	+30 dBm	26 dBm
Grid, 18 dBi	15 m of ½" Heliax @ 0.11 dB/m gives 1.65 dB loss	+30 dBm	13 dBm

2.2 Test Facility

2.2.1 General

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia. EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies' indoor open are test site (iOATS) has been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS-Gen Issue 8 - **Industry Canada iOATS number - IC 3569B**

2.2.2 NATA Accreditation

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO 17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI), NPL (UK), NIST (USA) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A^2LA).

EMC Technologies is accredited in Australia by the National Association of Testing Authorities (NATA). All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation.

The current full scope of accreditation can be found on the NATA website: www.nata.asn.au

It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

2.3 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd, Rohde and Schwarz, NMI, NPL or NIST. All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NPL and the working antennas (BiLog and horn) calibrated by EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

FCC PART 15 Subpart C (Section 15.247)

3.0 ANTENNA REQUIREMENT (§15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The EUT was provided with a specific antenna using a TNC connector. The EUT was intended to be installed by professionals and clear instruction was included in the installation manual about the antenna type.

4.0 OPERATION IN RESTRICTED BAND (§15.205)

The restricted band conformance was verified during the spurious emission tests for section 15.247. No emissions exceeded the restricted band limits.

5.0 CONDUCTED EMISSIONS (§15.207)

5.1 Test procedure

The arrangement specified in ANSI C63.4: 2009 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$V_{EMI} = V_{Rx} + LBPF$$

Where: V_{EMI} =   the Measured EMI voltage in dBµV to be compared to the limit.
          V_{Rx} =   the Voltage in dBµV read directly at the EMI receiver.
          LBPF   =   the insertion loss in dB of the cables and the Limiter and Band Pass Filter.

5.2 Results

The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

The sample was powered from a Cincon Electronics AC/DC supply model TR30RAM120, serial number 30120-0052243. An input at 110 V and 60 Hz was provided to the power supply.

Active Line, 0.15 - 30 MHz

Peak	Frequency [MHz]	Line	QP Level [dBµV]	Limit [dBµV]	Margin [±dB]	Av. Level [dBµV]	Limit [dBµV]	Margin [±dB]
1	17.21	Active	42.1	60.0	-17.9	36.5	50.0	-13.5
2	1.604	Active	36.2	56.0	-19.8	27.8	46.0	-18.2
3	25.30	Active	39.6	60.0	-20.4	34.3	50.0	-15.7
4	20.31	Active	39.3	60.0	-20.7	33.7	50.0	-16.3
5	1.046	Active	35.1	56.0	-20.9	27.2	46.0	-18.8
6	0.211	Active	42.3	63.2	-20.9	27.9	53.2	-25.3
7	3.765	Active	35.0	56.0	-21.0	24.4	46.0	-21.6
8	16.53	Active	38.8	60.0	-21.2	27.2	50.0	-22.8
9	0.280	Active	39.2	60.8	-21.6	27.2	50.8	-23.6
10	0.837	Active	34.2	56.0	-21.8	25.2	46.0	-20.8
11	4.669	Active	33.3	56.0	-22.7	22.8	46.0	-23.2
12	3.346	Active	33.0	56.0	-23.0	24.2	46.0	-21.8
13	0.150	Active	40.4	66.0	-25.6	25.1	56.0	-30.9

Neutral Line, 0.15 - 30 MHz

Peak	Frequency [MHz]	Line	QP Level [dBµV]	Limit [dBµV]	Margin [±dB]	Av. Level [dBµV]	Limit [dBµV]	Margin [±dB]
1	16.66	Neutral	44.9	60.0	-15.1	34.0	50.0	-16.0
2	17.08	Neutral	44.6	60.0	-15.4	34.8	50.0	-15.2
3	17.85	Neutral	43.4	60.0	-16.6	37.9	50.0	-12.1
4	0.837	Neutral	39.2	56.0	-16.8	29.2	46.0	-16.8
5	1.045	Neutral	38.6	56.0	-17.4	29.7	46.0	-16.3
6	0.491	Neutral	38.5	56.2	-17.7	30.7	46.2	-15.5
7	0.629	Neutral	38.2	56.0	-17.8	30.0	46.0	-16.0
8	0.374	Neutral	39.9	58.4	-18.5	33.8	48.4	-14.6
9	1.398	Neutral	37.2	56.0	-18.8	27.1	46.0	-18.9
10	3.415	Neutral	36.9	56.0	-19.1	26.1	46.0	-19.9
11	0.280	Neutral	41.5	60.8	-19.3	31.3	50.8	-19.5
12	3.696	Neutral	35.5	56.0	-20.5	25.8	46.0	-20.2
13	4.671	Neutral	35.2	56.0	-20.8	25.1	46.0	-20.9
14	20.16	Neutral	38.8	60.0	-21.2	32.7	50.0	-17.3
15	24.44	Neutral	38.1	60.0	-21.9	34.6	50.0	-15.4
16	0.150	Neutral	38.7	66.0	-27.3	27.7	56.0	-28.3

6.0   RADIATED EMISSIONS (§15.209)

The spurious emission conformance was verified during the spurious emission tests for section 15.247. No emissions exceeded the limits in the restricted bands.

7.0 HOPPING PROTOCOL (§15.247 (a)(1))

Each data packet destined for transmission was assigned a new channel. The radio selected the next channel from one of eight lookup tables of pseudo random channel information. The table included all of the channels.

The receiver and transmitter bandwidths were the same at a nominal 50 kHz.

The following table shows the random channel numbers stored in the 8 lookup tables.

Hop Index	Channel Number							
	NetID =0	NetID =1	NetID =2	NetID =3	NetID =4	NetID =5	NetID =6	NetID =7
1	0	94	309	210	14	126	68	263
2	193	252	160	248	140	342	58	231
3	226	200	150	262	41	298	251	15
4	222	274	289	222	229	208	83	53
5	29	33	218	258	232	91	42	299
6	67	176	20	142	58	243	123	18
7	311	206	303	117	157	291	43	293
8	77	165	152	197	12	124	224	378
9	31	118	26	48	213	9	320	0
10	96	194	83	138	125	159	92	215
11	7	106	60	79	262	94	206	153
12	44	65	334	29	62	301	56	223
13	127	285	205	67	113	221	49	37
14	75	111	154	175	233	245	266	272
15	145	345	8	223	0	263	139	193
16	102	268	59	71	26	177	33	309
17	20	181	125	320	163	178	115	220
18	138	169	18	4	199	269	10	85
19	55	232	206	276	82	28	71	34
20	81	335	80	194	217	280	214	217
21	148	171	73	214	242	129	317	257
22	327	10	135	226	148	105	176	121
23	128	77	195	129	93	13	190	219
24	1	105	142	23	300	138	16	279
25	165	69	187	58	138	287	170	238
26	60	261	189	14	7	253	180	159
27	132	209	106	296	114	325	172	138
28	4	204	136	146	189	320	211	97
29	3	292	143	322	79	135	191	92
30	335	138	40	306	27	53	276	164
31	246	161	88	227	23	110	8	206
32	63	9	295	189	72	34	156	64
33	178	40	203	6	277	66	84	350
34	169	136	32	137	222	63	138	93
35	361	88	284	49	248	79	65	239
36	46	6	213	32	5	88	97	168
37	42	122	112	299	52	198	150	357
38	27	203	166	149	105	151	222	151
39	53	207	24	85	274	49	175	105
40	253	95	282	54	187	239	242	22
41	72	86	78	110	80	7	196	201
42	338	66	123	221	95	146	281	205
43	171	173	244	217	9	77	59	136
44	120	80	180	256	74	271	39	106
45	333	43	111	81	1	27	289	33
46	93	125	139	243	111	288	113	141
47	73	338	118	8	24	248	99	190
48	71	364	97	280	161	43	93	87
49	257	89	33	144	110	249	51	173
50	244	49	102	192	156	76	79	112
51	57	32	58	234	269	317	154	167
52	157	218	134	28	97	83	6	135
53	228	16	241	176	165	85	350	119
54	95	90	263	229	15	101	11	320
55	221	41	45	212	10	37	88	11
56	90	17	90	1	150	62	104	44
57	204	93	105	163	250	30	72	75
58	109	27	4	220	54	283	112	352
59	65	72	286	127	131	5	70	13
60	167	82	169	130	50	340	22	313
61	17	60	314	72	164	29	12	286
62	54	92	52	43	202	122	108	240
63	32	239	49	245	193	197	263	8
64	144	85	208	265	324	33	248	161
65	297	59	47	170	347	207	181	163
66	9	137	67	104	281	24	267	156
67	154	18	153	100	320	75	167	89
68	207	229	324	19	63	48	148	83
69	274	244	91	64	106	148	209	386
70	40	145	308	369	194	74	221	55
71	225	12	82	98	103	89	229	343
72	180	87	15	305	201	200	122	134

73	156	365	30	80	357	217	290	276
74	103	174	129	148	99	56	144	145
75	184	143	301	46	261	189	132	258
76	88	277	68	40	30	386	271	229
77	13	288	148	9	120	65	323	1
78	214	30	321	342	240	311	27	187
79	38	29	98	318	8	206	23	181
80	367	2	131	61	356	22	249	162
81	281	21	290	2	245	361	252	40
82	308	48	280	253	220	356	173	102
83	175	201	161	70	57	2	96	228
84	247	75	113	216	101	109	44	122
85	231	363	288	218	183	240	26	2
86	181	100	216	295	235	268	74	104
87	140	230	157	264	69	190	321	171
88	177	256	264	26	29	14	160	10
89	135	22	151	121	135	295	227	184
90	117	139	23	57	147	139	210	36
91	220	159	330	211	272	182	226	109
92	122	141	63	303	46	86	116	110
93	268	189	95	143	49	270	64	98
94	153	275	119	90	253	71	318	323
95	238	28	254	69	44	266	103	234
96	160	334	250	18	258	211	48	157
97	62	81	304	238	238	103	28	144
98	108	64	179	141	325	195	228	261
99	328	4	338	385	275	227	273	317
100	287	11	215	287	21	144	166	188
101	183	53	11	183	342	81	256	29
102	162	272	29	59	84	147	250	274
103	329	78	116	87	216	152	128	243
104	188	62	101	105	278	365	286	132
105	39	276	56	292	211	118	182	56
106	263	246	77	106	166	42	193	300
107	305	101	190	338	19	230	47	140
108	223	131	43	91	128	261	158	126
109	100	104	42	196	108	61	19	78
110	295	63	371	199	153	246	245	253
111	101	97	9	84	302	8	205	16
112	119	243	171	88	83	132	288	107
113	374	350	13	191	141	338	361	178
114	289	55	227	185	231	220	140	266
115	284	297	126	374	22	364	383	24
116	265	360	239	215	126	319	185	351
117	61	311	209	161	107	131	351	247
118	298	103	311	340	375	183	100	285
119	216	38	128	193	225	115	106	314
120	389	296	390	21	260	136	171	281
121	306	310	333	319	123	72	225	60
122	155	109	28	7	393	113	394	120
123	174	61	65	195	25	170	355	42
124	397	349	234	5	398	114	247	227
125	344	135	87	12	353	310	381	335
126	6	372	144	108	130	229	359	246
127	334	241	395	269	372	156	130	95
128	199	220	310	198	132	394	340	393
129	356	158	61	153	286	282	331	250
130	269	384	25	386	151	362	110	367
131	187	217	396	241	389	374	357	176
132	322	0	352	190	78	286	387	182
133	345	386	242	75	60	15	94	54
134	355	24	382	297	267	92	330	218
135	186	160	204	63	175	201	261	232
136	235	315	275	361	89	289	62	113
137	395	247	353	255	109	370	143	268
138	19	175	278	355	159	377	348	160
139	330	147	132	186	118	366	63	271
140	267	396	16	66	339	258	179	152
141	45	263	22	174	181	133	168	347
142	316	140	375	307	395	6	324	23
143	33	318	268	315	104	214	272	338
144	52	333	339	272	335	171	165	143
145	320	134	146	268	321	202	343	21
146	113	58	231	99	64	0	363	114
147	197	56	114	162	345	296	262	294
148	210	380	276	300	65	302	169	139
149	354	126	380	235	13	332	102	346
150	319	351	172	82	230	157	285	124
151	239	51	100	73	282	128	80	50
152	134	347	230	250	399	360	312	311
153	366	183	66	123	100	127	159	382
154	325	387	277	55	143	215	95	59
155	390	197	115	370	373	166	342	51
156	215	26	35	324	264	383	73	262
157	307	327	199	124	182	20	151	264
158	243	321	293	366	158	44	125	303
159	49	266	145	310	288	389	336	77
160	114	177	41	96	308	191	297	365
161	232	20	76	157	116	64	295	146
162	111	202	103	267	386	99	199	203

163	302	233	229	365	364	84	142	306
164	348	127	194	348	243	318	197	334
165	14	331	156	323	76	70	152	267
166	37	214	85	171	307	11	275	52
167	291	278	343	372	237	188	368	58
168	121	148	376	390	271	392	161	158
169	182	271	48	394	31	140	389	101
170	201	262	243	266	341	90	21	363
171	252	383	108	89	397	359	354	199
172	392	167	327	24	385	226	194	242
173	310	31	170	261	371	93	243	383
174	80	79	285	206	17	234	66	96
175	163	376	201	339	39	349	14	392
176	342	129	294	378	327	212	326	116
177	272	149	370	379	144	225	255	133
178	324	282	394	291	67	12	269	3
179	74	68	1	350	127	54	278	197
180	254	312	183	362	185	209	105	308
181	22	231	320	182	270	45	147	180
182	195	336	355	39	266	23	35	397
183	309	120	214	393	380	120	53	259
184	23	348	262	337	241	308	390	358
185	377	250	365	285	40	314	13	17
186	104	284	237	316	71	267	75	66
187	229	354	198	111	362	196	327	391
188	363	162	130	346	304	265	178	127
189	161	187	315	373	367	347	213	150
190	28	316	74	317	195	351	335	63
191	206	113	362	341	86	19	393	362
192	137	294	104	52	376	353	282	71
193	372	301	312	224	293	398	291	288
194	250	98	240	131	152	399	319	394
195	185	45	186	389	358	21	36	125
196	336	213	272	159	366	210	294	345
197	259	323	366	177	284	162	61	84
198	152	70	340	387	228	185	280	67
199	296	397	84	122	88	242	364	361
200	86	332	120	37	47	51	1	204
201	30	359	302	31	294	218	385	251
202	388	168	81	25	305	384	388	189
203	15	286	177	358	208	247	237	273
204	87	259	10	277	171	237	89	237
205	393	314	173	327	68	117	46	170
206	141	164	266	101	276	205	298	332
207	339	308	261	225	119	57	332	282
208	237	375	388	119	265	123	20	305
209	369	36	356	36	42	290	307	48
210	304	245	220	334	61	26	187	30
211	130	385	222	344	172	224	220	326
212	11	36	5	154	312	184	201	254
213	368	255	279	30	91	380	344	360
214	48	265	251	381	139	250	3	32
215	212	302	246	326	338	238	268	318
216	139	257	188	164	368	348	365	154
217	357	146	367	308	51	228	244	131
218	256	234	7	247	226	98	29	73
219	166	287	62	139	112	199	292	364
220	173	346	322	384	20	108	25	265
221	84	99	337	330	318	256	241	128
222	176	399	307	201	170	222	198	255
223	323	186	121	274	317	307	399	260
224	387	144	318	44	190	112	77	395
225	326	221	319	53	388	16	17	304
226	97	219	348	168	146	264	308	166
227	264	260	299	213	184	231	346	214
228	373	377	69	237	204	379	192	155
229	143	339	255	78	351	335	186	207
230	58	223	50	236	303	321	314	80
231	115	358	99	279	81	333	375	328
232	47	343	385	364	160	375	259	12
233	82	170	155	244	210	294	119	186
234	110	300	344	51	186	125	40	319
235	381	23	6	184	334	223	162	165
236	375	392	219	93	212	100	360	72
237	133	368	217	155	329	10	117	94
238	209	303	336	349	122	336	60	341
239	124	320	92	150	295	194	277	324
240	370	319	182	367	313	281	54	291
241	261	389	373	282	37	164	313	79
242	200	110	247	335	96	150	284	289
243	64	226	317	263	365	241	283	245
244	123	304	164	180	289	187	337	327
245	276	46	271	20	256	368	369	297
246	68	42	31	230	361	95	153	208
247	360	123	259	42	179	154	382	387
248	332	83	75	301	155	381	232	25
249	159	307	228	259	396	388	207	7
250	236	374	202	321	102	3	386	230
251	24	39	53	188	352	18	124	6
252	365	14	138	92	257	32	202	174

253	16	112	335	278	348	137	219	248
254	76	367	221	181	333	46	137	202
255	79	283	393	38	330	55	32	4
256	213	341	225	312	227	158	367	389
257	198	306	323	62	38	322	311	68
258	341	355	269	242	117	251	341	20
259	136	224	39	27	32	39	177	379
260	142	188	287	228	374	121	81	129
261	50	216	127	50	94	219	329	340
262	379	378	19	293	340	355	189	14
263	343	180	184	15	331	174	184	39
264	146	47	0	167	236	17	347	172
265	208	395	368	187	56	163	349	88
266	270	76	44	109	169	141	91	398
267	352	193	341	179	343	107	384	194
268	285	52	162	128	73	337	322	225
269	118	237	257	376	234	67	230	169
270	271	199	21	325	297	87	353	118
271	125	313	305	145	298	262	287	301
272	399	54	369	356	384	331	78	369
273	279	381	326	45	66	59	55	339
274	230	208	133	158	90	303	377	185
275	205	269	122	251	332	285	239	222
276	359	191	141	294	191	305	129	195
277	358	108	57	22	11	165	265	76
278	56	205	79	133	336	372	0	100
279	240	289	258	371	223	119	302	183
280	190	394	200	204	246	299	260	388
281	251	211	27	160	252	276	356	252
282	300	117	383	219	326	38	134	374
283	337	330	329	239	137	180	305	5
284	170	151	325	135	268	315	120	46
285	51	184	392	125	3	344	234	331
286	262	192	377	359	45	346	149	287
287	129	57	107	231	350	363	164	333
288	151	212	224	169	77	254	136	103
289	43	280	372	77	259	373	391	198
290	89	352	207	132	28	236	57	269
291	99	270	360	298	133	173	87	130
292	168	155	94	249	383	161	135	31
293	398	119	357	116	369	176	163	330
294	227	357	245	288	87	106	37	41
295	158	19	137	281	287	97	4	147
296	293	179	89	136	168	304	216	283
297	69	210	238	290	322	175	109	99
298	78	362	292	260	296	232	396	375
299	371	172	193	304	53	31	131	45
300	242	5	181	354	273	47	174	373
301	12	1	223	94	48	153	392	244
302	386	156	328	270	214	169	118	111
303	36	190	361	289	219	329	246	235
304	376	198	265	232	16	357	24	249
305	266	153	350	35	314	35	300	298
306	315	228	363	363	285	213	309	356
307	278	96	384	380	154	312	145	342
308	179	35	359	115	192	354	90	384
309	349	391	397	332	290	369	395	179
310	224	299	46	351	311	339	254	216
311	98	225	398	240	249	350	279	292
312	331	242	38	396	323	78	257	385
313	105	185	260	207	310	395	50	256
314	258	7	178	328	177	273	45	108
315	318	369	345	200	33	73	208	19
316	351	371	72	60	328	371	306	123
317	218	235	252	34	280	309	223	49
318	286	388	374	397	251	102	371	316
319	92	50	347	388	381	244	238	226
320	21	295	273	329	145	186	240	354
321	219	329	196	3	34	104	127	399
322	150	398	147	65	200	58	41	212
323	317	324	281	95	188	1	379	65
324	245	150	36	102	180	278	15	70
325	282	166	55	173	176	316	338	381
326	290	366	34	33	142	25	253	370
327	147	328	158	203	162	328	212	47
328	131	340	249	86	291	181	236	233
329	94	128	378	399	390	160	18	275
330	191	326	93	398	370	341	38	290
331	362	130	313	47	121	252	358	295
332	255	91	140	391	382	40	303	353
333	340	73	270	112	315	111	69	390
334	394	74	226	286	173	255	334	175
335	2	132	349	233	178	216	31	35
336	172	337	2	360	301	4	301	81
337	241	248	37	172	196	272	233	236
338	126	353	387	107	2	168	107	74
339	382	325	14	16	316	378	34	192
340	383	322	379	134	224	116	2	310
341	25	196	210	275	215	277	372	86
342	385	382	159	283	279	292	126	9

343	202	236	283	17	363	167	304	321
344	277	71	192	120	6	145	293	177
345	353	163	291	156	360	390	7	196
346	70	273	300	302	292	68	231	213
347	106	154	54	208	299	143	183	210
348	303	34	185	113	129	396	328	137
349	194	309	296	166	59	260	296	359
350	313	373	298	140	136	343	86	348
351	8	13	167	126	35	391	217	355
352	10	182	71	353	244	259	398	344
353	59	254	149	392	98	203	333	82
354	346	114	12	178	205	397	310	322
355	396	342	165	246	255	274	370	296
356	41	290	211	202	198	387	141	90
357	192	298	3	357	70	179	366	241
358	35	102	253	311	394	297	85	315
359	211	25	117	151	206	69	345	62
360	116	195	168	147	115	80	258	372
361	380	44	331	395	85	149	373	43
362	288	305	96	284	207	334	146	371
363	283	37	306	83	346	345	157	38
364	292	370	342	333	377	352	380	336
365	107	251	86	165	75	233	133	337
366	189	215	233	383	254	306	270	28
367	164	84	316	252	197	130	82	142
368	66	249	256	68	167	376	378	191
369	83	267	64	209	203	235	264	377
370	234	133	354	257	55	284	188	366
371	26	121	364	271	239	50	5	211
372	91	264	176	114	218	96	52	117
373	149	107	399	336	349	313	76	209
374	233	379	163	345	392	324	376	115
375	18	361	346	343	263	293	315	27
376	248	281	248	41	378	367	9	349
377	314	279	51	205	4	323	200	312
378	301	317	110	118	43	192	114	278
379	112	115	70	313	149	257	325	380
380	203	390	274	254	92	326	352	280
381	275	238	236	152	124	330	195	307
382	350	393	232	309	344	172	274	57
383	312	8	17	382	379	393	362	270
384	85	222	174	368	134	193	101	224
385	294	227	212	10	209	41	98	148
386	273	157	389	273	18	279	204	368
387	364	258	197	13	319	155	30	329
388	34	253	386	103	36	300	397	376
389	5	291	381	11	309	327	203	284
390	378	67	267	352	354	142	155	149
391	196	116	109	314	387	60	299	302
392	347	240	175	74	306	275	218	221
393	217	3	297	377	247	82	374	325
394	280	15	358	375	359	382	67	61
395	391	344	351	0	174	52	235	396
396	249	178	191	56	355	204	339	91
397	321	356	124	97	283	385	121	69
398	384	124	235	347	337	36	111	277
399	299	142	391	76	391	134	316	26
400	260	293	332	331	221	358	215	200

8.0   HOPPING CHANNEL SEPARATION (§15.247 (a)(1))

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Maximum 20 dB bandwidth was measured as 54.3 kHz (refer to section 6) so this value was used as the limit.

Measurement results are shown in the following graphs.
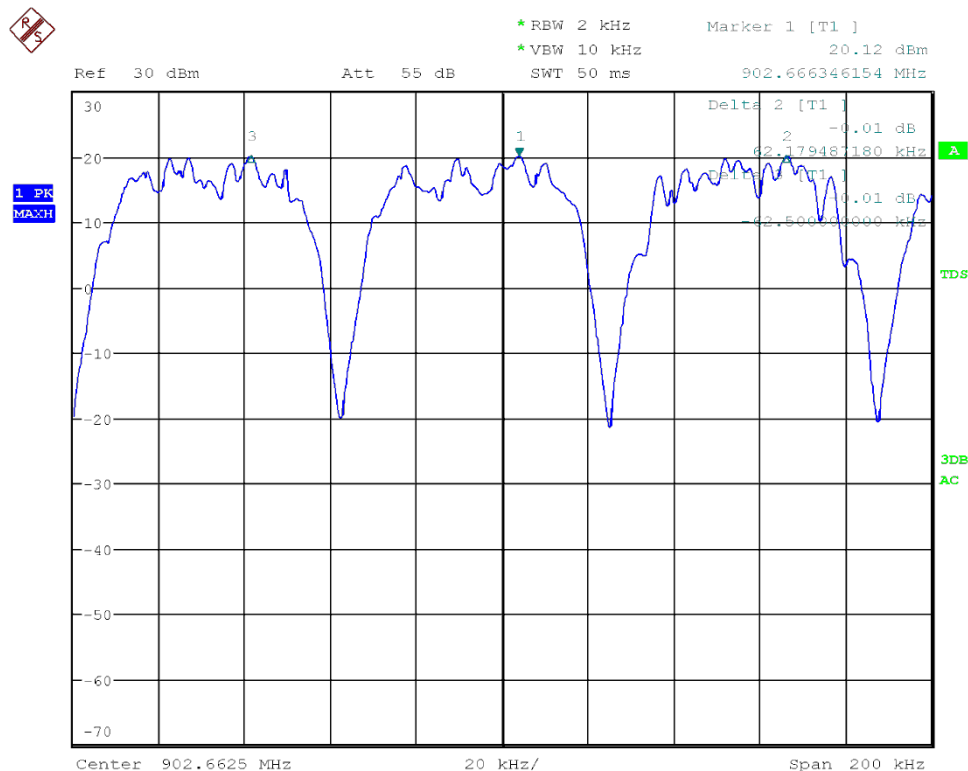
Tx Range	Separation (kHz)	Limit (kHz)	Result
Low	62.18	> 54.3	Pass

Graph 1: Channel separation, low range

Tx Range	Separation (kHz)	Limit (kHz)	Result
Middle	62.50	> 54.3	Pass
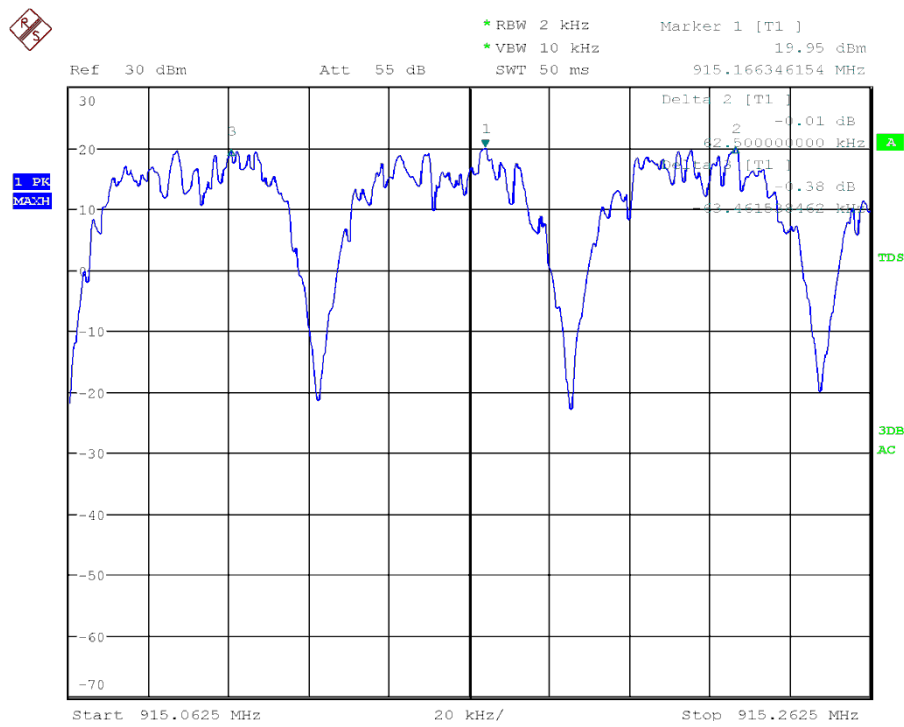
Graph 2: Channel separation, middle range

Tx Range	Separation (kHz)	Limit (kHz)	Result
High	62.82	> 54.3	Pass
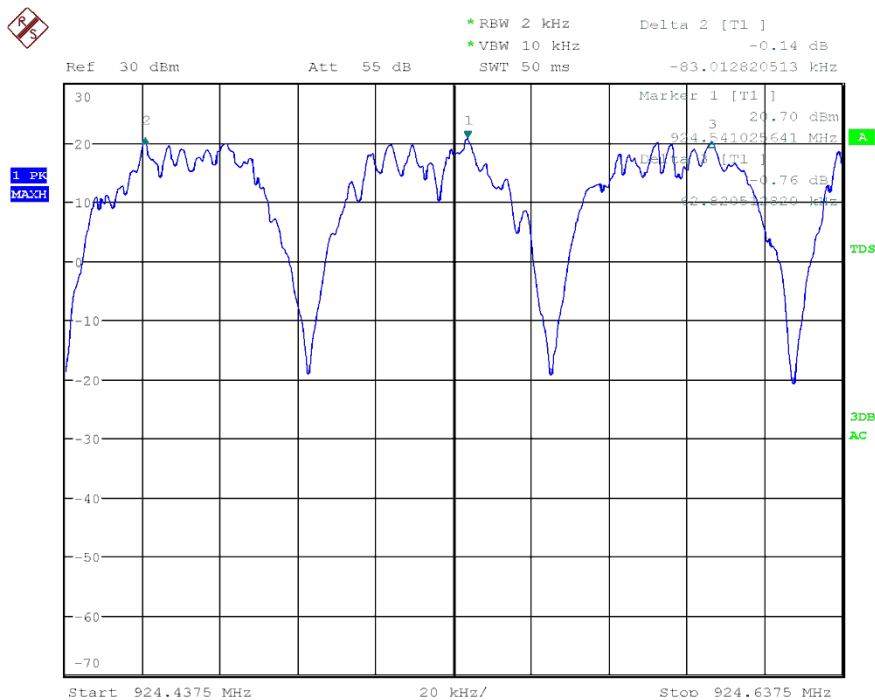
Graph 3: Channel separation, high range

9.0   20 dB BANDWIDTH ((§15.247 (a)(1)(i))

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. Measurements were performed on low, middle and high channel. The EUT was operating at its maximum data rate (64QAM modulation).
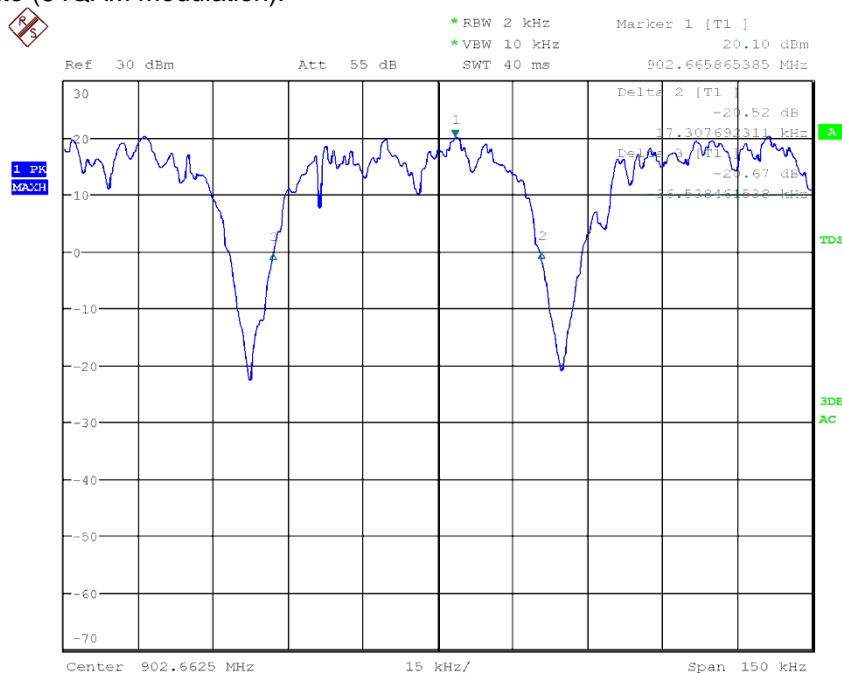
Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
Low	53.8	500	Pass

Graph 4: 20 dB bandwidth, low channel
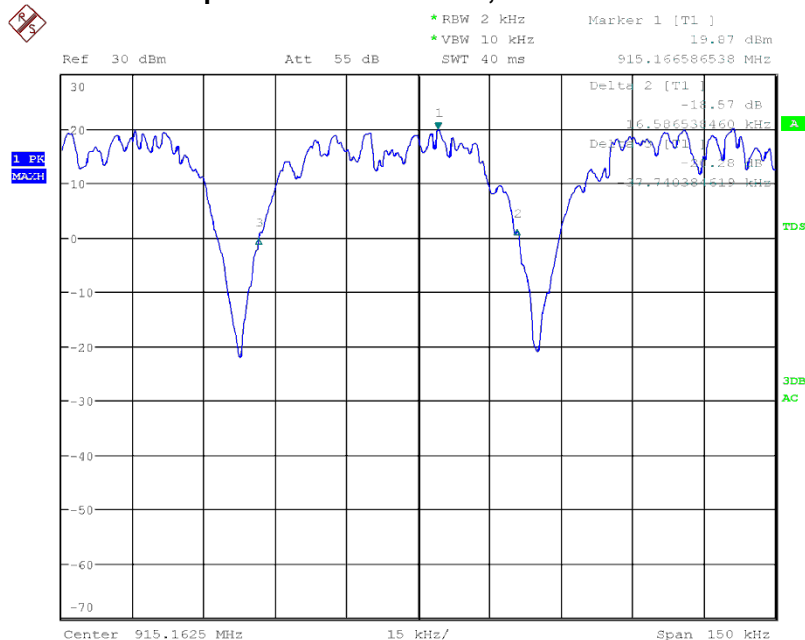
Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
Middle	54.3	500	Pass

Graph 5: 20 dB bandwidth, middle channel
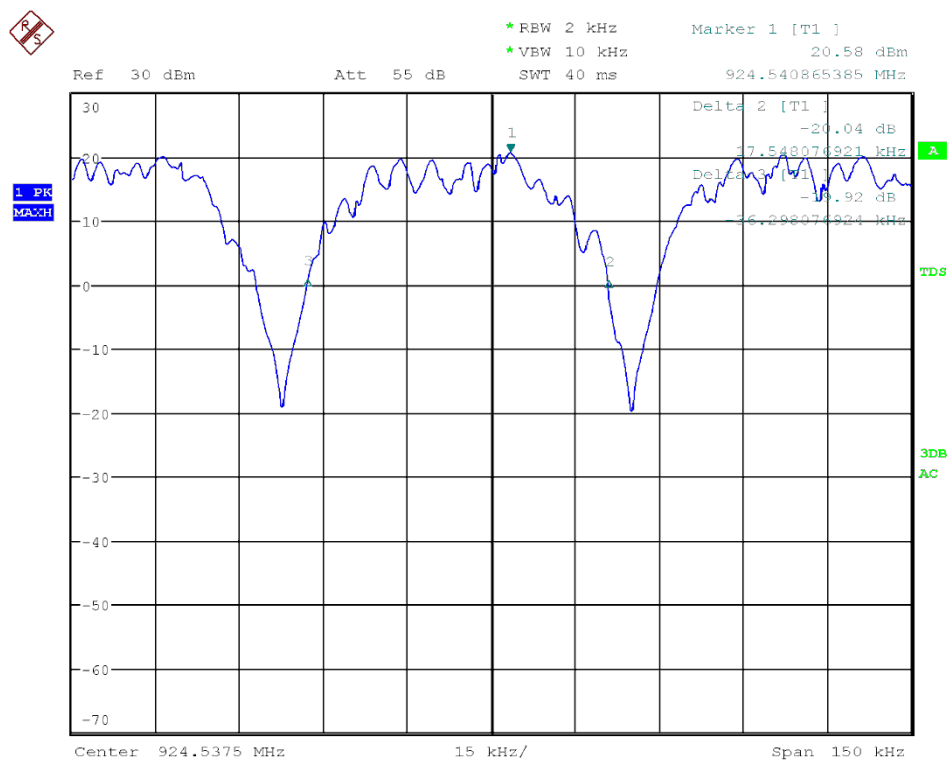
Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
High	53.8	500	Pass

Graph 6: 20 dB bandwidth, high channel

10.0 NUMBER OF HOPPING FREQUENCIES (§15.247 (a)(1)(i))

As the measured 20 dB bandwidth was less than 250 kHz, the EUT had to use minimum of 50 hopping frequencies. Measurements were performed on low, middle and high frequency range of the transmitter.
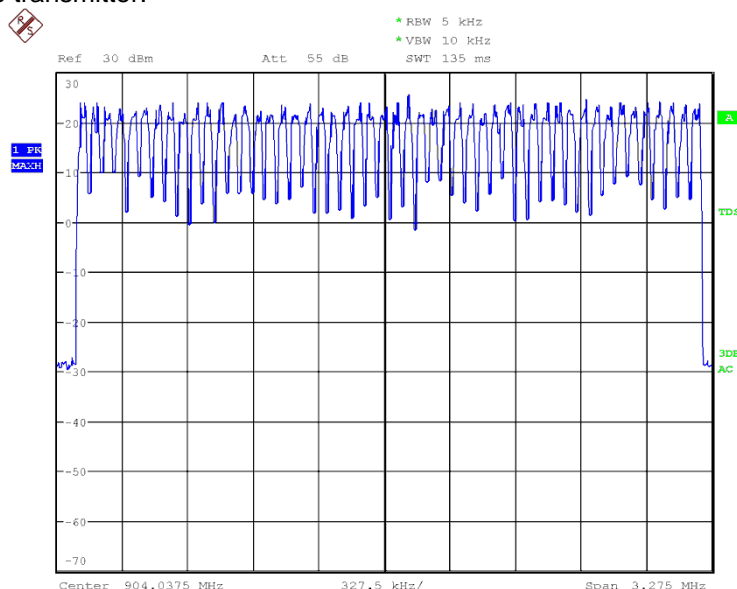
Tx Range	Number of hopping frequencies	Limit (kHz)	Result
Low	50	50	Pass

Graph 7: Number of hopping frequencies, low range
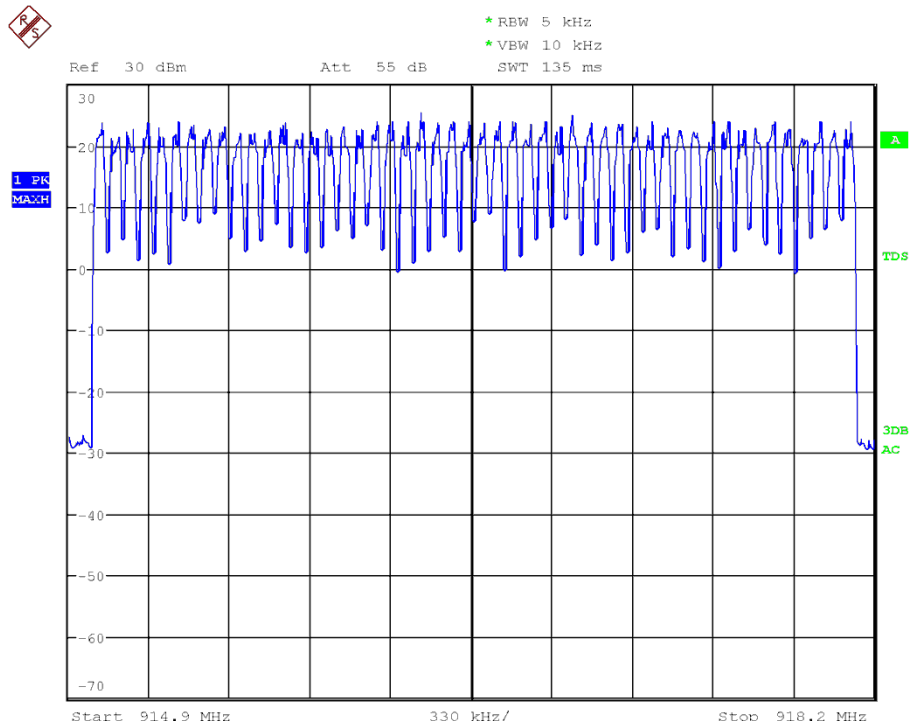
Tx Range	Number of hopping frequencies	Limit (kHz)	Result
Middle	50	50	Pass

Graph 8: Number of hopping frequencies, middle range
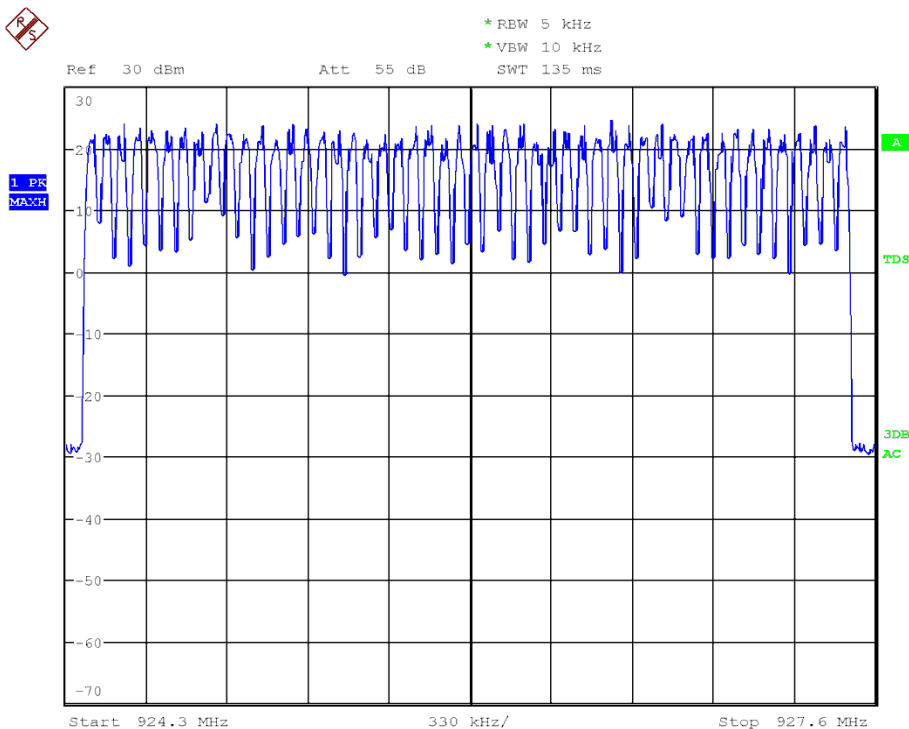
Tx Range	Number of hopping frequencies	Limit (kHz)	Result
High	50	50	Pass

Graph 9: Number of hopping frequencies, high range

11.0   DWELL TIME (§15.247 (a)(1)(i))

As the measured 20 dB bandwidth was less than 250 kHz, the average time of occupancy on any frequency had to be less than or equal to 0.4 seconds within a 20 second period. Measurements were performed using a spectrum analyser operating in zero span and tuned on a hopping frequency. Results are shown in the following table.

Channel	Dwell time (ms)	Limit (ms)	Result
Low	93.75	400	Pass
Middle	93.84	400	Pass
High	93.75	400	Pass

12.0   PEAK OUTPUT POWER (§15.247 (b)(2))

Peak conducted power was measured at the output of the transmitter. Cable loss between connector and spectrum analyser was accounted for in reading. The following spectrum analyser setting was used for the measurement.
Centre Frequency = Channel to be measured
Span = 0 Hz
RBW = 100 kHz
VBW = 300 kHz
Sweep = auto
Detector function = peak
Trace = max hold

Results are shown in the below table.

Modulation	Channel	Power Setting (dBm)	Conducted Power (dBm)	Limit (dBm)	Result
64QAM	Low	+23	29.2	30	Pass
	Middle	+23	29.1	30	Pass
	High	+23	29.3	30	Pass
16QAM	Low	+24	29.2	30	Pass
	Middle	+24	29.1	30	Pass
	High	+24	29.3	30	Pass
QPSK	Low	+26	29.2	30	Pass
	Middle	+26	29.1	30	Pass
	High	+26	29.3	30	Pass

The maximum allowed e.i.r.p. for this type of transmitter was 4 Watts (36 dBm) and therefore an antenna assembly with maximum directional gain of up to 6 dBi could be used.

13.0   BAND-EDGE EMISSION MEASUREMENTS

Band-edge emission shall be measured up to 2 standard bandwidth (100 kHz in the frequency range of 30 MHz-1 GHz) from the edge of the authorized transmit band. However measurement range was extended to 2 MHz during the test. Emissions within 2 MHz of an authorized band edge were measured using the marker-delta method. The in-band emission of section 9 was used while applying marker-delta method.

All emissions above and below the edge of the authorised band were more than 20 dB below the in band intentional emission.

Measurement results are shown in the following graphs.
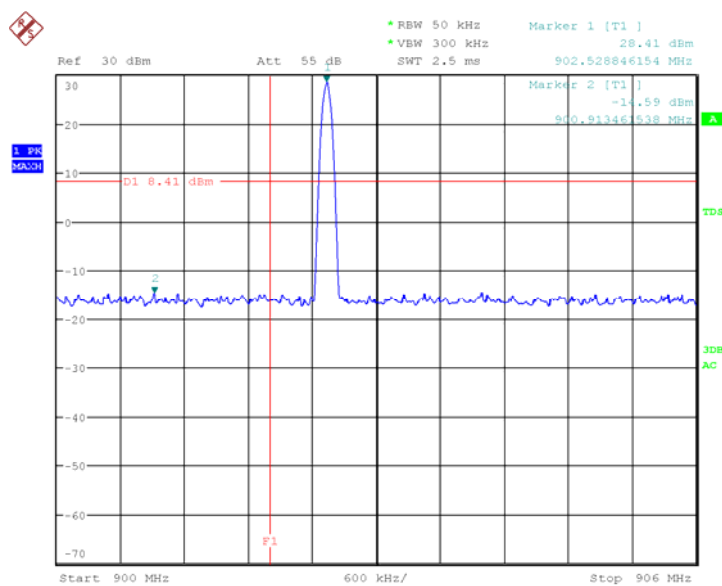
Lowest channel transmitting
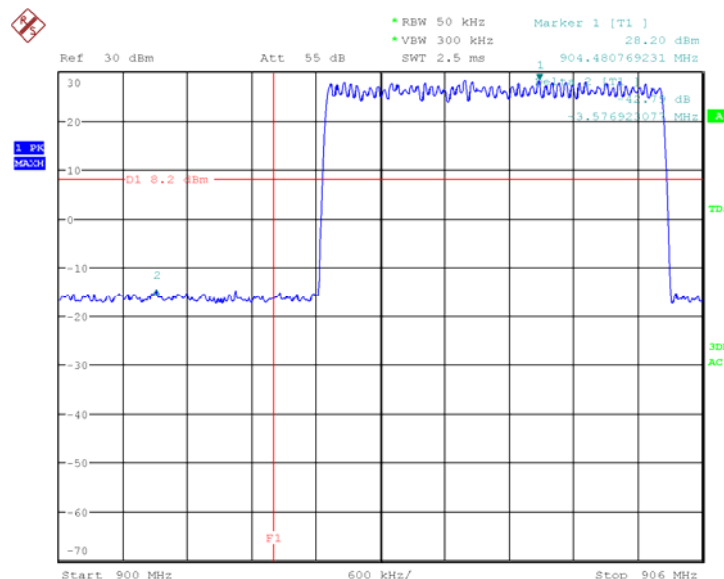
Hopping modulation active

Vertical marker F1 was positioned at 902 MHz. Marker 1 showed the peak in-band emission and marker 2 showed the peak band edge emission.

| In Band Emission from Clause 9 (dBm)	Delta from graph (dB)	Band Edge Emission (dBm)	Limit (dBm)	Margin (dB)	Result
28.63	-42.79	-14.16	8.63	-22.79	Pass

Graph 10: Lower band-edge emissions
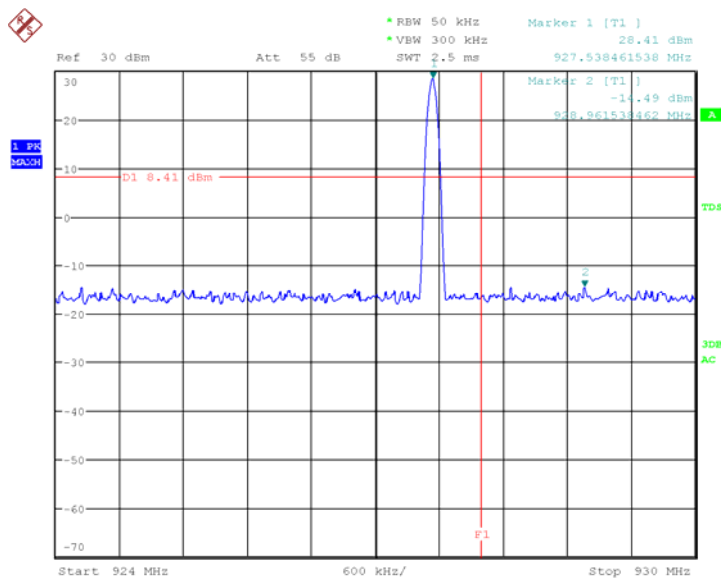
Highest channel transmitting
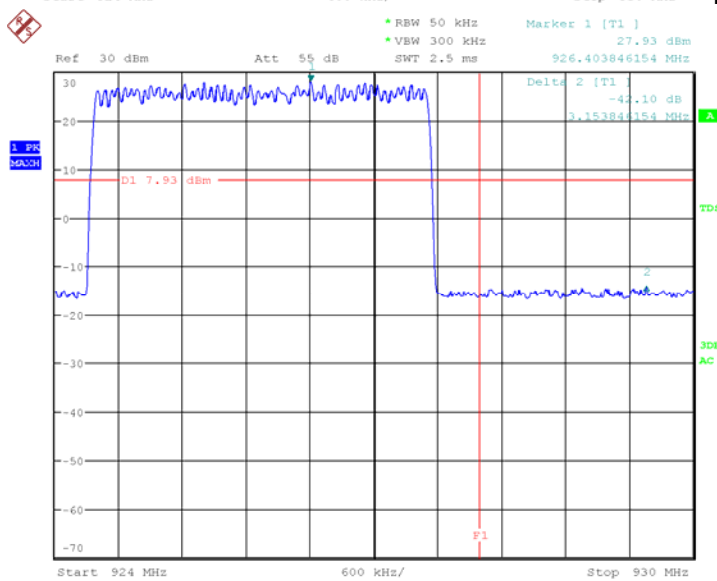
Hopping modulation active

Vertical marker F1 was positioned at 928 MHz. Marker 1 showed the peak in band emission and marker 2 showed the peak band edge emission.

In Band Emission from Clause 9 (dBm)	Delta from graph (dB)	Band Edge Emission (dBm)	Limit (dBm)	Margin (dB)	Result
28.63	-42.1	-13.47	8.63	-22.1	Pass

Graph 11: Upper band-edge emissions

All emissions were more than 20 dB below the maximum in-band emission.

14.0 SPURIOUS EMISSION MEASUREMENTS (§15.247 (d))

14.1 Emission in non-restricted bands (Conducted measurements)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Maximum in band emission of 28.63 dBm, measured in section 9 was used as a reference to determine the spurious emission limit. Thus the spurious emission limit was 8.63 dBm. The EUT was transmitting with the hopping function enabled during the test.
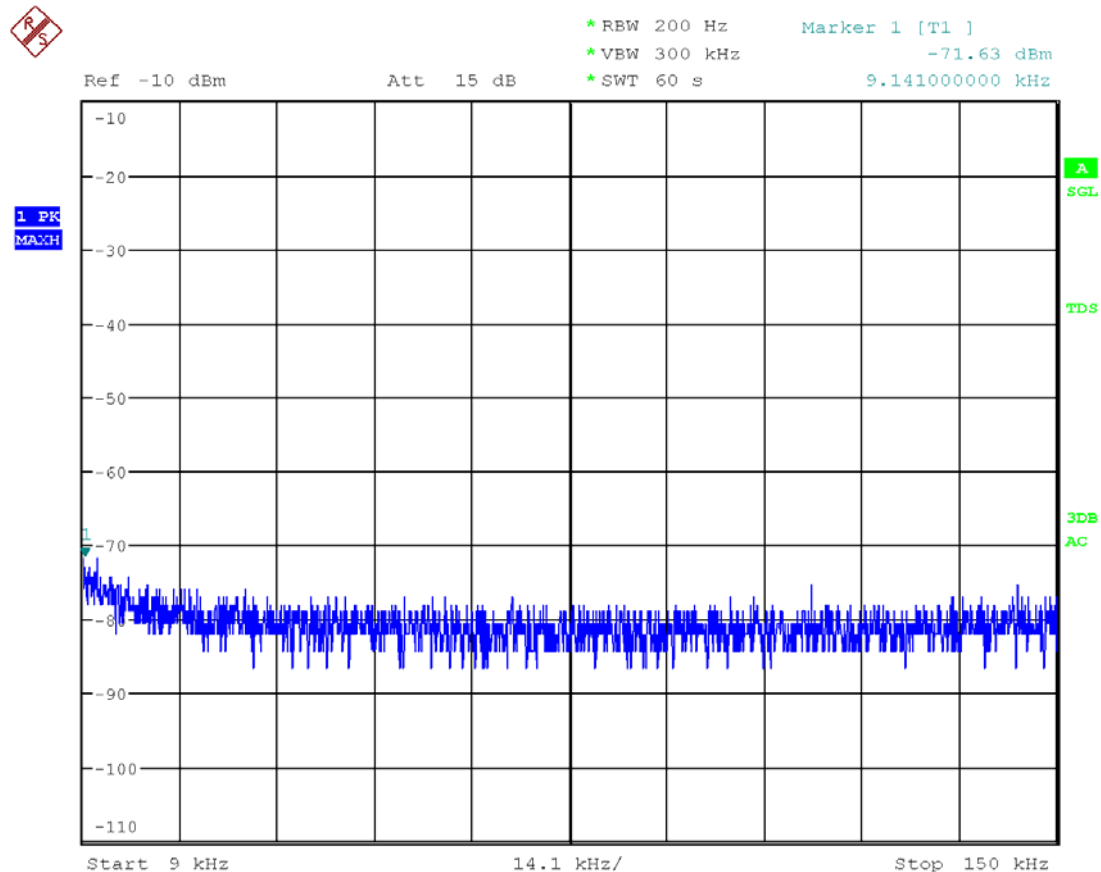
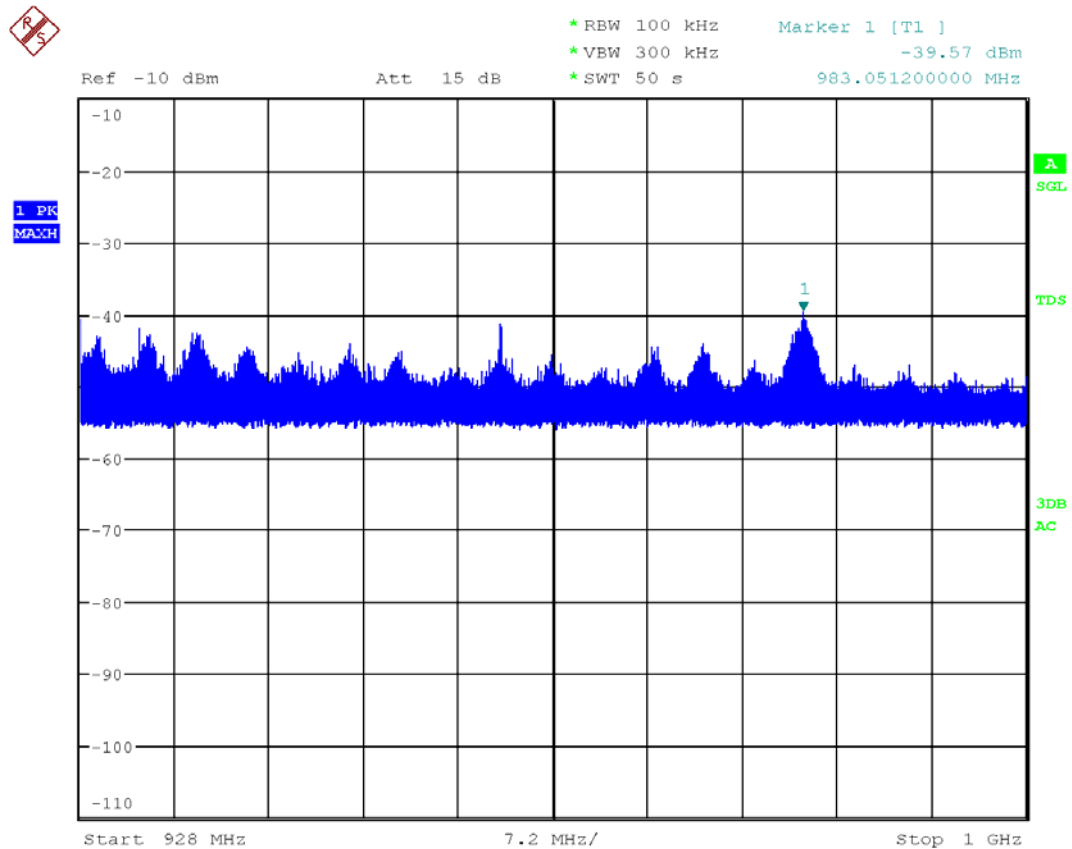**Graph 12: Conducted spurious emissions (non-restricted band), 9 kHz-150 kHz**

Graph 13: Conducted spurious emissions (non-restricted band), 150 kHz-30 MHz

Graph 14: Conducted spurious emissions (non-restricted band), 30 MHz-902 MHz

Graph 15: Conducted spurious emissions (non-restricted band), 928 MHz-1 GHz
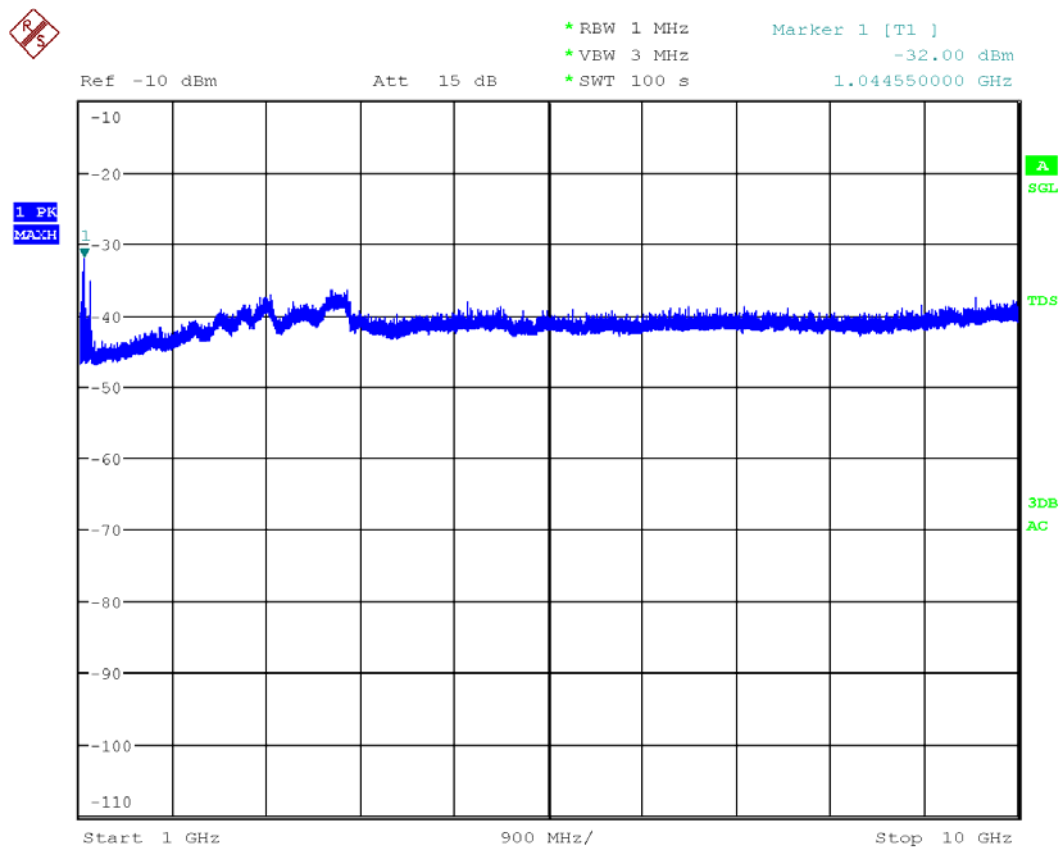
Graph 16: Conducted spurious emissions (non-restricted band), 1 GHz-10 GHz

No emissions were within 20 dB of the spurious limit.

14.2   Emission in restricted bands (radiated measurements)

In order to ensure the compliance to the requirements of emission in restricted bands, radiated measurements were performed. Frequency range of 9 kHz to 10 GHz was investigated for any emission falling in restricted frequency bands. Provisions of FCC 15.35 were observed selecting the detector and bandwidth. Limits of FCC 15.209 were applied.

The EUT was placed 0.8 m and 1.5 m above the floor during the test for frequency range of below 1 GHz and above 1 GHz respectively. The EUT was checked in three orthogonal planes to determine maximum emission, only the worst case is reproduced for the report.

Radiated EMI tests were performed inside a compliant CISPR16-1-4 semi-anechoic chamber for a 2m x 2m x 2m test volume up to 18 GHz, at a test distance of 10, 3 and 1 metres. The EUT was set up on the table top (placed on turntable). The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated loop antenna was used for measurements between 9 kHz and 30 MHz. A calibrated Biconilog antenna was used for measurements between 30 MHz and 1000 MHz. Calibrated horn antenna were used for measurements between 1 to 10 GHz.

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz was measured using a following setting:
Peak measurements setting: RBW = VBW = 1 MHz
Average measurements setting: RBW = 1 MHz and VBW = 10 Hz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. The procedure was repeated with the device orientated in three orthogonal axis to further maximise the emission.

Each significant peak was investigated with the Quasi-peak, Peak or Average Detectors as appropriate. The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical antenna polarisations.

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

E = V + AF - G + L
Where:
   E   =   Radiated Field Strength in dBμV/m.
   V   =   EMI Receiver Voltage in dBμV. (measured value)
  AF =   Antenna Factor in dB. (stored as a data array)
   G   =   Preamplifier Gain in dB. (stored as a data array)
   L   =   Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

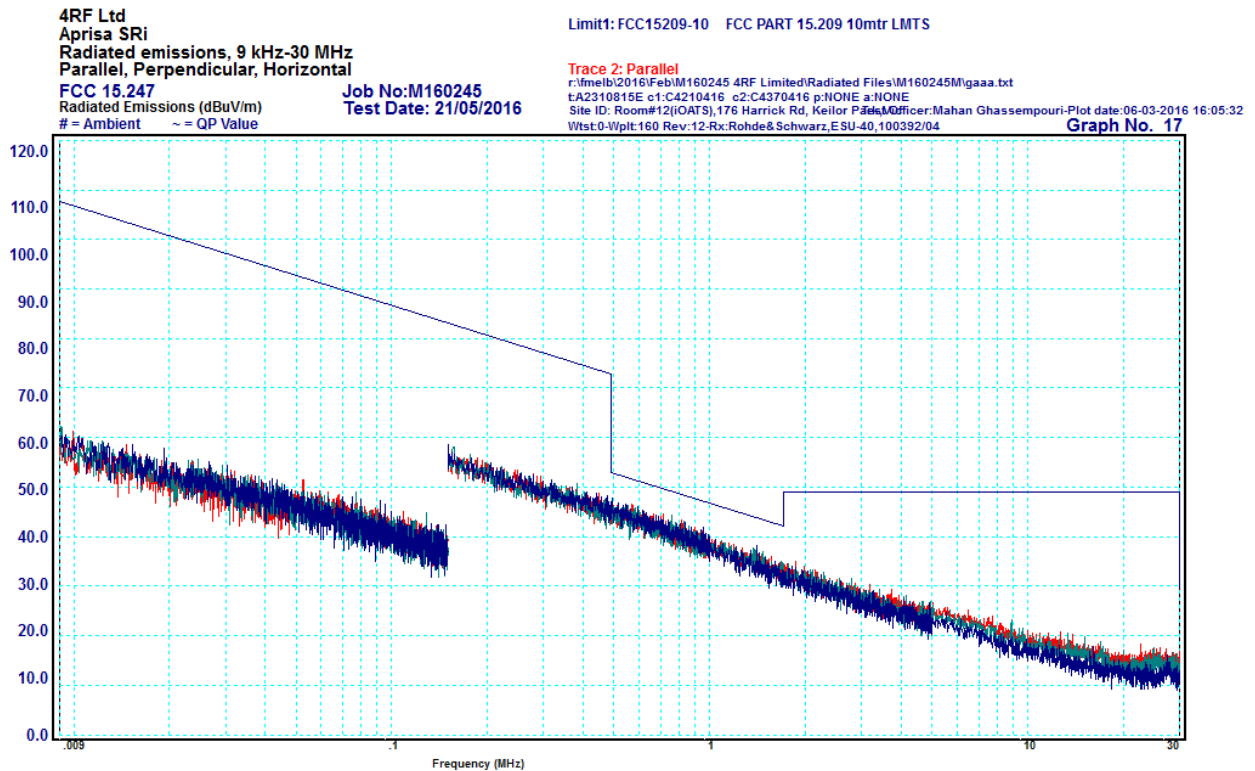- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dBμV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB (1/m). The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

34.0 + 9.2 + 1.9 - 20 = 25.1 dBμV/m

4RF Ltd
Aprisa SRi
Radiated emissions, 9 kHz-30 MHz
Parallel, Perpendicular, Horizontal
FCC 15.247   **Job No:M160245**
Radiated Emissions (dBuV/m)   **Test Date: 21/05/2016**
= Ambient   ~ = QP Value

Limit1: FCC15209-10   FCC PART 15.209 10mtr LMTS

Trace 2: Parallel
r:\fmelb\2016\Feb\M160245 4RF Limited\Radiated Files\M160245M\gaaa.txt
t:A2310815E c1:C4210416 c2:C4370416 p:NONE a:NONE
Site ID: Room#12(iOATS),176 Harrick Rd, Keilor Park,Vic.Officer:Mahan Ghassempouri-Plot date:06-03-2016 16:05:32
Wtst:0-Wplt:160 Rev:12-Rx:Rohde&Schwarz,ESU-40,100392/04   **Graph No. 17**

Graph 17: 9 kHz-150 kHz, radiated emissions in restricted bands

No emissions were detected above noise floor

4RF Ltd
Aprisa SRi, Radiated emissions, 30MHz-1GHz
Red: Vertical
Green Horizontal
FCC 15.247
Radiated Emissions (dBuV/m)
= Ambient   ~ = QP Value

Job No:M160245
Test Date: 12-4-2016

Limit1: FCC15209-10   FCC PART 15.209 10mtr LMTS

Trace 2: Vertical Emissions
R:\FMELB\2016\FEB\M160245 4RF LIMITED\RADIATED FILES\M160245R\GraphV.bmp
t:A3630516 c1:C4220416 c2:C4370416 p:NONE a:NONE
Site ID: Room#12(iOATS),176 Harrick Rd, Keilor Park,Test Officer:Larry Phuah-Plot date:06-20-2016 15:53:50
Wtst:0-Wplt:160 Rev:12-Rx:Rohde&Schwarz,ESCI-3,100011/00   Graph No. 1
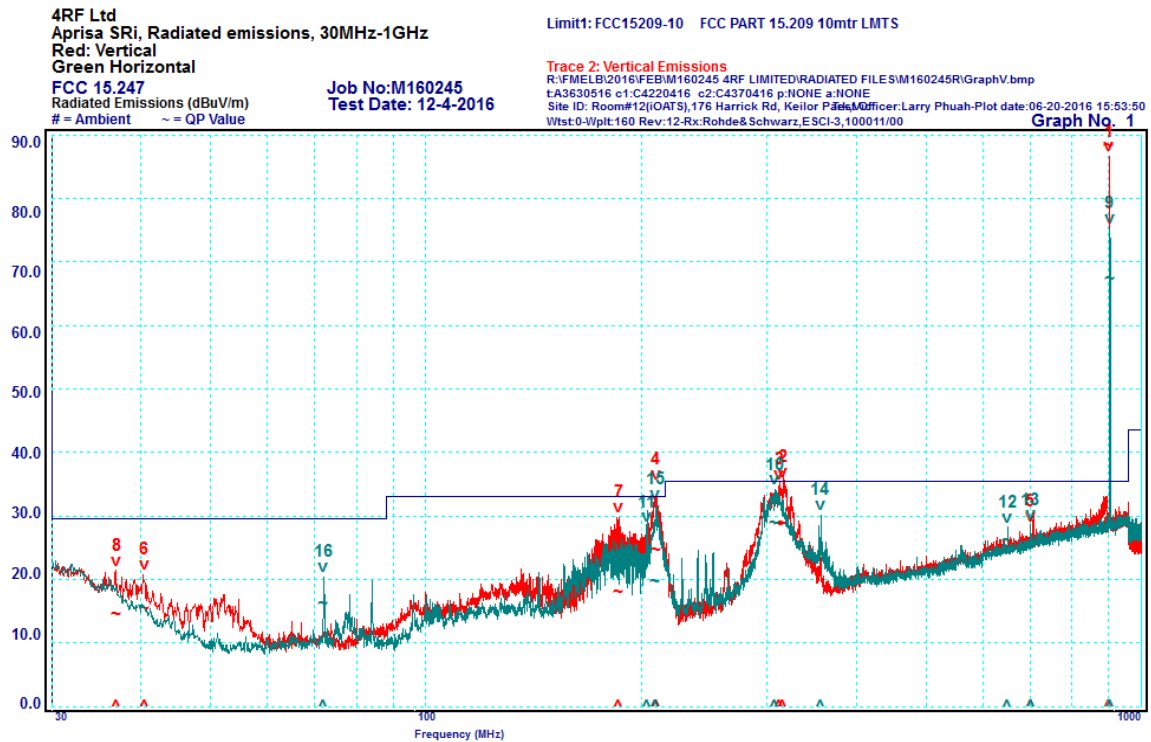
Peak	Frequency (MHz)	Polarisation	Measured QP Level (dBµV/m)	QP Limit (dBµV/m)	ΔPeak ±dB
*1	902.00	Vertical	-	-	-
2	315.84	Vertical	28.7	35.5	-6.8
3	311.80	Vertical	28.6	35.5	-6.9
4	209.81	Vertical	24.6	33.0	-8.4
5	699.99	Vertical	26.2	35.5	-9.3
6	40.46	Vertical	15.3	29.5	-14.2
7	186.24	Vertical	18.0	33.0	-15.0
8	36.98	Vertical	14.5	29.5	-15.0
*9	902.54	Horizontal	-	-	-
10	307.30	Horizontal	28.9	35.5	-6.6
11	203.99	Horizontal	26.3	33.0	-6.7
12	650.00	Horizontal	26.0	35.5	-9.5
13	700.02	Horizontal	25.5	35.5	-10.0
14	356.08	Horizontal	22.9	35.5	-12.6
15	209.44	Horizontal	19.5	33.0	-13.5
16	72.020	Horizontal	16.0	29.5	-13.5

* Note: Intentional radiation is excluded from spurious emission limit.

Graph 18: 30 MHz –1 GHz, radiated emissions in restricted bands

4RF Ltd
Aprisa SRi, Radiated emissions, 1 GHz-10 GHz, Peak
Red: Vertical
Green: Horizontal
FCC 15.247
Radiated Emissions (dBuV/m)   Job No:M160245
= Ambient   ~ = PK Value   Test Date: 30/04/2016

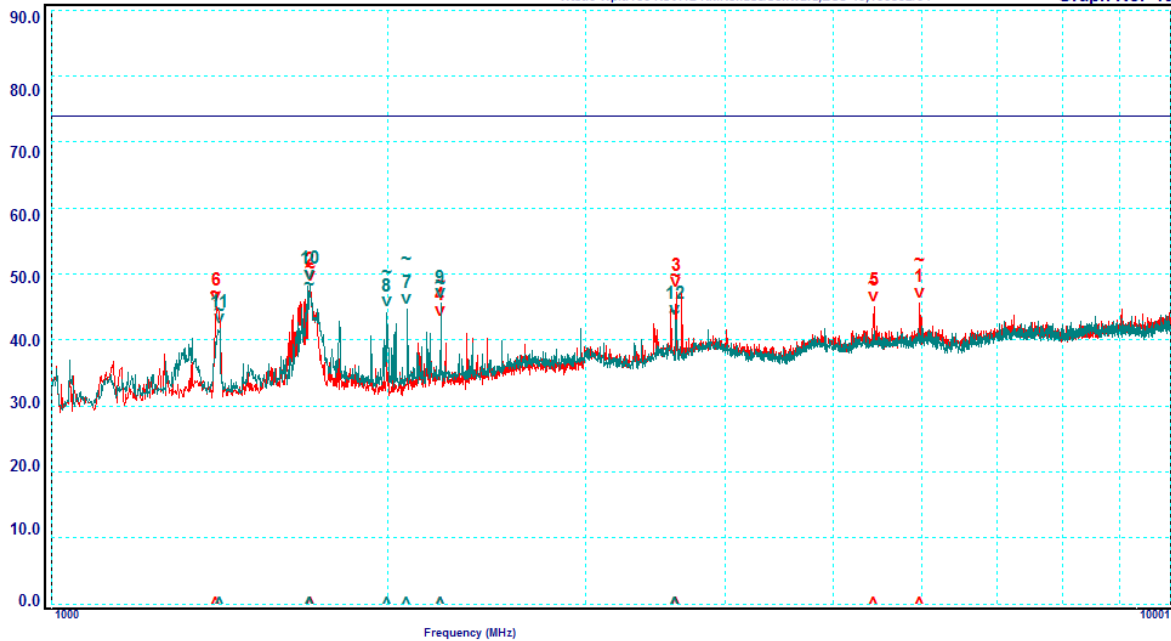Limit1: FCC15209Pk   FCC PART 15.209, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical
r:\fmelb\2016\Feb\M160245 4RF Limited\Radiated Files\M160245G\GraphV.bmp
t:A0040516 c1:C3370716 c2:NONE p:A2880516 a:
Site ID: Room#12(iOATS),176 Harrick Rd, Keilor Park,VicTest Officer:Mahan Ghassempouri-Plot date:06-03-2016 17:06:30
Wtst:0-Wplt:160 Rev:12-Rx:Rohde&Schwarz,ESU-40,100392/04   **Graph No. 19**

Peak	Frequency (MHz)	Polarisation	Measured Peak Level (dBμV/m)	Peak Limit (dBμV/m)	ΔPeak ±dB
1	5967.55	Vertical	52.0	74.0	-22.0
2	1704.66	Vertical	50.9	74.0	-23.1
3	3616.04	Vertical	49.6	74.0	-24.4
4	2227.53	Vertical	48.6	74.0	-25.4
5	5433.10	Vertical	48.6	74.0	-25.4
6	1405.11	Vertical	47.0	74.0	-27.0
7	2079.01	Horizontal	52.2	74.0	-21.8
8	1994.16	Horizontal	50.2	74.0	-23.8
9	2227.41	Horizontal	48.6	74.0	-25.4
10	1703.33	Horizontal	48.4	74.0	-25.6
11	1415.72	Horizontal	44.6	74.0	-29.4
12	3610.88	Horizontal	44.1	74.0	-29.9

Graph 19: 1 GHz – 10 GHz, radiated emissions in restricted bands, peak detector

4RF Ltd
Aprisa SRi, Radiated emissions, 1 GHz-10 GHz, Average
Red: Vertical
Green: Horizontal
FCC 15.247
Radiated Emissions (dBuV/m)
= Ambient   ~ = AV Value

Job No:M160245
Test Date: 30/04/2016

Limit1: FCC15209Av   FCC PART 15.209, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical
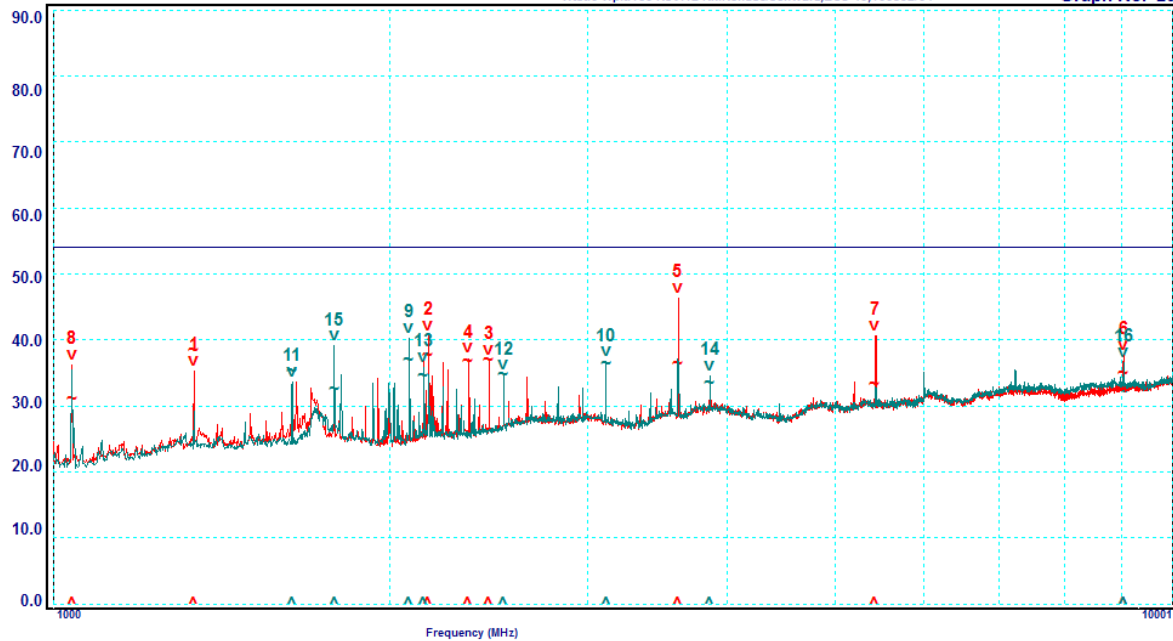r:\fmelb\2016\Feb\M160245 4RF Limited\Radiated Files\M160245G\GraphV.bmp
t:A0040516 c1:C3370716 c2:NONE p:A2880516 a:
Site ID: Room#12(iOATS),176 Harrick Rd, Keilor Park,VIC,Officer:Mahan Ghassempouri-Plot date:06-03-2016 17:13:31
Wtst:0-Wplt:160 Rev:12-Rx:Rohde&Schwarz,ESU-40,100392/04   Graph No. 20

Peak	Frequency (MHz)	Polarisation	Measured Average Level (dBµV/m)	Average Limit (dBµV/m)	∆Average ±dB
1	1336.56	Vertical	38.4	54.0	-15.6
2	2163.86	Vertical	37.7	54.0	-16.3
3	2449.99	Vertical	37.0	54.0	-17
4	2349.98	Vertical	36.7	54.0	-17.3
5	3615.63	Vertical	36.4	54.0	-17.6
6	9043.52	Vertical	34.9	54.0	-19.1
7	5421.57	Vertical	33.2	54.0	-20.8
8	1039.47	Vertical	31.0	54.0	-23
9	2079.04	Vertical	37.0	54.0	-17
10	3118.54	Horizontal	36.4	54.0	-17.6
11	1633.44	Horizontal	35.3	54.0	-18.7
12	2524.44	Horizontal	34.7	54.0	-19.3
13	2142.63	Horizontal	34.5	54.0	-19.5
14	3861.06	Horizontal	33.4	54.0	-20.6
15	1782.15	Horizontal	32.5	54.0	-21.5
16	9043.43	Horizontal	32.1	54.0	-21.9

Graph 20: 1 GHz – 10 GHz, radiated emissions in restricted bands, average detector

15.0   FREQUENCY HOPPING CHANNEL APPLICATION (§15.247 (g))

The following description of the hopping mechanism was provided by the customer:

Each packet destined for transmission over the air was assigned a new channel. The radio selected the next required channel from one of eight lookup tables of pseudo random channel information; each table containing all channels that were sequentially indexed by the software. Should an indexed channel not appear in the white list (a user selectable list of channels to be used), the channel was skipped and the next channel was selected. If the user attempted to save a white list with fewer that the minimum number of channels (50) the save was aborted, thereby preventing operation with fewer than 50 channels.

The Base ID determined which lookup table was used and this value was entered into each base station and all remote stations associated with that particular Base; this provided a low correlation between overlapping networks having different Base ID.

16.0   INCORPORATION OF INTELLIGENCE WITHIN FHSS (§15.247 (h))

The transmitter did not implement dynamic channel avoidance.

17.0   RADIO FREQUENCY EXPOSURE (HAZARD) (§15.247 (i))

The EUT complied with FCC requirements for human exposure. Refer to EMC Technologies test report No. M160245-2. The declared minimum operating distance was **30 cm** as stated in the operating manual.

The maximum antenna assembly gain maintaining the exposure level within the limit is 8.3 dBi. Antenna gains exceeding **6 dBi** as stated in Part 15.247(b)(4) are not permitted without reducing the power settings by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

18.0   COMPLIANCE STATEMENT

4RF 900 MHz band frequency hopping radio, Model: SI902M160 tested on behalf of 4RF Ltd, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

Summary of results are shown in below table:

FCC Part 15 Subpart C	Test Performed	Results
15.203	Antenna requirement	Complied
15.205	Operation in restricted Band	Complied
15.207	Conducted emissions limits	N/A as the EUT is DC powered
15.209	Radiated emissions limits	Complied
15.247 (a)(1)	Hopping channel separation	Complied
15.247 (a)(1)(i)	20 dB bandwidth Number of hopping frequencies Dwell time	Complied
15.247 (a)(2)	Minimum 6 dB Bandwidth	N/A as the EUT employs FH
15.247 (b)(2)	Peak Output Power	Complied
15.247 (c)	Antenna Gain > 6 dBi	N/A as EUT was supplied with an antenna of less than 6 dBi gain.
15.247 (d)	Out of Band Emissions	Complied
15.247 (e)	Peak Power Spectral Density	N/A as the EUT employs FH
15.247 (f)	Hybrid Systems	N/A assessed to FH requirements
15.247 (g)	Hopping channel application	Complied
15.247 (h)	Incorporation of intelligence within FHSS	Complied
15.247 (i)	Radio Frequency Hazard	Complied

N/A: Not Applicable
FH: Frequency hopping

19.0   UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainty for emissions tests shown within this report are as follows:

Conducted Emissions: 9 kHz to 30 MHz   ±3.2 dB

Radiated Emissions: 9 kHz to 30 MHz   ±4.1 dB
                                   30 MHz to 300 MHz   ±5.1 dB
                                   300 MHz to 1000 MHz   ±4.7 dB
                                   1 GHz to 18 GHz   ±4.6 dB
                                   18 GHz to 26 GHz   ±5.1 dB

Peak Output Power: ±1.5 dB

Peak Power Spectral Density: ±1.5 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

APPENDIX A

MEASUREMENT INSTRUMENT DETAILS

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yy	Due Date dd/mm/yy	Cal. Interval
Chamber	Frankonia SAC-10-2 (R-139)	10/01/2016	10/01/2017	1 Year, *1
EMI Receiver	R&S ESU40 20 Hz – 40 GHz Sn: 100392 (R-140)	19/11/2015	19/11/2016	1 Year, *2
	R&S ESU40 20 Hz – 40 GHz Sn: 100182 (R-037)	18/02/2016	18/02/2017	1 Year, *2
	HP 8546A Sn: 3520A00249 & 3448A00287 (R-017)	10/11/2015	10/11/2016	1 Year, *2
Antennas	SUNOL JB6 BICONILOG 30 – 6000 MHz Sn. A012312 (A-363)	16/05/2014	16/05/2016	2 Year, *2
	EMCO 3115 Broadband Horn 1 – 18 GHz Sn. 8908-3282 (A-004)	09/05/2013	09/05/2016	3 Year, *1
	AH-118 Com-Power Horn Antenna 1 – 18 GHz Sn. 71168	19/05/2013	19/05/2016	3 Year, *1
	EMCO 6502 Active Loop Antenna 20 Hz – 30 MHz Sn. 9311-2801	20/07/2015	20/07/2018	3 Year, *1

Note *1. Internal NATA calibration.
Note *2. External NATA / A2LA calibration